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THE ISLAND OF CUBA.

We present in this issue a series of views illustrative of the city of Havana and the adjacent country, which were gathered during a recent tour through the island. Cuba is larger in area and population and richer in natural resources than is generally supposed. It has a total area of 43,319 square miles and a population of one and a half million souls. The distance from its eastern to its western extremity is nearly equal to the distance from New York to Chicago. To a soil of unusual fertility nature has added a climate which is peculiarly favorable to the growth of certain special crops of great value. The country may be broadly divided into the region of plains, the rolling uplands and the forest lands. The lowlands form a practically continuous belt around the island, and in them are to be found the great sugar plantations. Above these, and on the lower slopes of the hills, are found the grazing and farm lands, upon which, among other things, is raised the famous Havana tobacco. The balance of the island, especially the eastern portion, is covered with a dense forest growth.

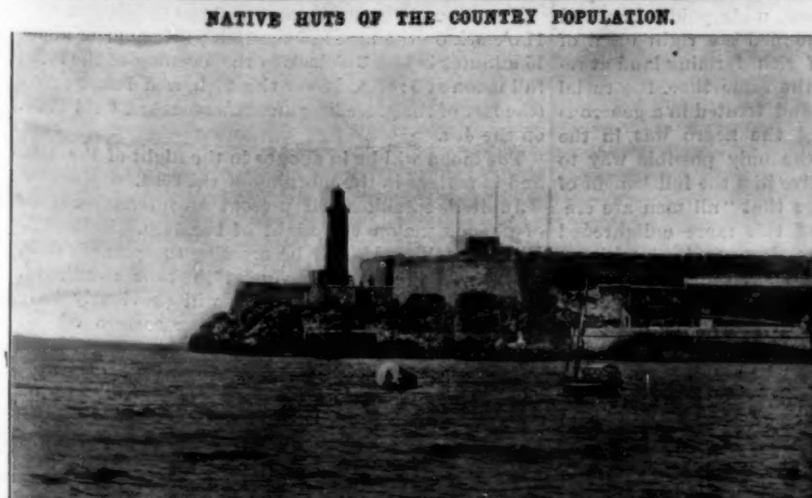
The sugar plantations form the chief source of wealth in Cuba. The cane grows best in the level bottom lands, which are cleared of all shrub and timber growth for this purpose. Some of the plantations are of vast extent, including as many as 10,000 acres, and they stretch away in unbroken monotony on all sides of the batey, which is the name by which the collection of sugar mills, dwellings, stables, etc., in the center of the plantation is known. Roads or driveways are cut through the cane and radiate in all directions, and along these the teams drag the heavily laden carretas to the mills. The Cuban does not place a heavy yoke upon the shoulders of the oxen, as we do, but uses a lighter yoke, which he lashes across the horns of each pair, so that a Cuban team pushes its load with the head. At the mill the cane is unloaded on to an endless belt, which carries it into the crushers.

The crushed cane, which is known as bagasse, is used for fuel, and the extracted juice is conveyed to large vats, where it is boiled. At a certain stage of the boiling it is transferred to pans, where it crystallizes to a brown sugar, which is then placed in long cylindrical moulds, where the molasses is allowed to run off. The sugar is now of a light yellow color, and, to further cleanse it, it is placed in centrifugal separators, where the molasses that still remains is removed, and the sugar, which is now fairly white in appearance, is ready for export. The average production is about 2,000 pounds to one acre. In former days, when the work was done by slaves, they were housed in quarters known as the barracon, which were located within the inclosure of the batey. Although in some parts of the island the laborers occupy the old slave quarters, it is now a common thing for the laborers to live in separate homes, scattered in the neighborhood of the plantations. They are very primitive dwellings, and consist of a square frame of posts, upon which is nailed a layer of boards, the interstices being plastered up with adobe clay. The roofs are thatched with palm leaf, the

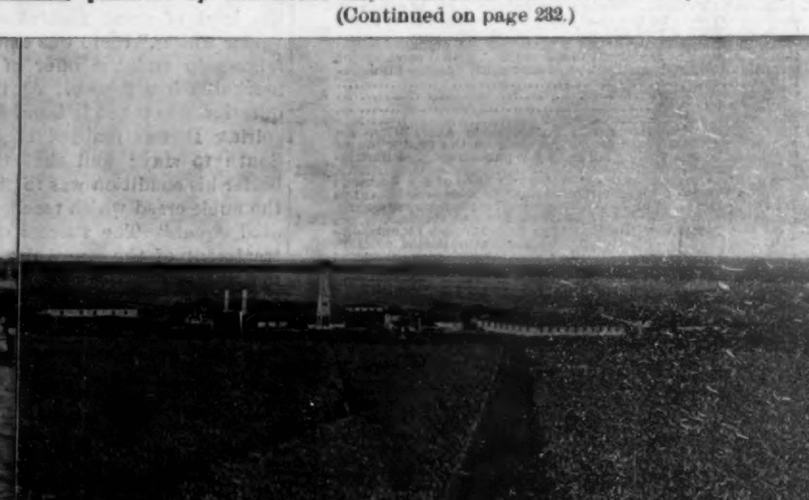
(Continued on page 232.)

A STRETCH OF UPLAND FARMING COUNTRY IN CUBA.

NATIVE HUTS OF THE COUNTRY POPULATION.



MORO CASTLE AT THE ENTRANCE TO HAVANA HARBOR.



A CUBAN SUGAR PLANTATION.

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THE NEW SOUTH.

In the current number of the SUPPLEMENT will be found the digest of a lecture recently delivered by Mr. Carroll D. Wright on "The New Industrial South." The lecture, as was natural, dealt largely with statistics, and statistics are ordinarily dry reading; but in this case, as Mr. Wright justly observed, "figures are more eloquent, when dealing with industrial affairs, than any other form of expression. They give in concrete form the results of great enterprises; they crystallize the moving history of the time."

This "moving history" has been a truly remarkable one, and in some respects unparalleled in the history of the world. In its opening chapters we find a country drained of its resources, and its people decimated by a succession of the most sanguinary battles of modern times. The emancipation of the slaves had torn the social fabric of the South asunder. The very foundation stones upon which its social and political economy had been built were swept away. The patriarchal life of the plantation was gone for ever; and when the survivors of the war came back and hung up the saber and the rifle upon the wall, they sat down in the solitude of their deserted homes to think out a new problem of existence. The outlook was as dark as could well be conceived. With its treasury exhausted, its credit gone, the flower of its manhood cut off by war and lost in the oblivion of scattered and nameless graves, with its industries paralyzed, its cities ruined, and its fair lands a wilderness of desolation—truly this country was as piteous a spectacle as was ever left in the track of a long and bitter war.

In those first years of convalescence, the Southern people began dimly to see the truth, which now in the day of their industrial triumph is clearly manifest, namely, that the fundamental idea of the old plantation life was false in itself and fatal to the industrial and social development of the country. Had it not been for the upheaval of the war, it is likely that the South of to-day would have been in very much the same condition as it was in the antebellum days. Labor, as represented in the negro, would have been perfectly content to remain in a state of childish ignorance and simplicity; and capital, as represented in the planters, would have continued indolently to spread its lap to receive the lavish contributions of a soil of unusual fertility. In such a life there was neither incentive nor opportunity for that industrial activity which at once enriches the treasury and builds up the character of a people. In the broad division of the people into the two classes of masters and slaves there was no provision for those gradations which seem to be inseparable from a successful social economy; and so there was developed a species of nondescript unfortunate, known as the "poor white."

Before the war, and for many years after it, a landed aristocracy did but little to encourage the inflow of capital and industrial enterprise from the outside world; and to this may be largely attributed the stagnation which marked the first fifteen years of the latter period. Partly because she made no effort to attract it, and partly because it was so steadily and artificially guided to the Western and Northwestern States, the tide of immigration set steadily past the Southern country; and while the barren lands and virgin forests of the West have been peopled with the best elements of European immigration, much of the fertile land of the South has lain idle for want of a husbandman.

Happily for this country, however, there was a section of the older men of the South which, aided by the younger and progressive generation, was equal to the task of translating the lessons of the war into vigorous and aggressive action. To them is due the development of the hitherto neglected, but wonderfully varied and plentiful, mineral wealth of the country. Capital was invited to enter, and to the immigrant, who hitherto had looked with distrust upon the land of great plantations, underpaid labor, and "poor whites," there was extended the right hand of fellowship and the offer of rich farming land at remarkably low figures. At the same time, the racial question was taken in hand and treated in a generous spirit. It was realized that the negro was in the South to stay; and that the only possible way to better his condition was to give him the full benefit of the noble creed which teaches that "all men are created equal." The success of this more enlightened treatment of the negro depends upon its intelligent and discriminating application. As Mr. Wright very pointedly put it: "Philanthropy cannot make a negro into a Circassian. We should endeavor to make out of him as good a negro as possible, and so educate him along industrial lines that he will become a valuable economic factor." The spirit displayed by the promoters of the Atlanta Exposition in regard to the negro showed with what practical common sense the question is now being treated. An exhibit devoted to the products of colored labor was housed in a building specially erected for the purpose; and the once despised race saw their own spokesman rivaling the eloquence of the distinguished orators of the day upon a common platform.

To any one who has had the opportunity to travel through the Southern States and take note of her natural resources, the statistics of her industrial development during the last decade are full of promise.

In a certain sense her agricultural development has only just begun. Large as is the cotton crop, it only represents a fraction of the productive powers of the soil. At present the South is a one-crop country, and therefore is subject to distressing extremes of fortune. A more varied agriculture would at once make her richer and financially more stable. This will come with the division of the large plantations, or a portion of them, into smaller farms, and the settlement of these farms by hardy and energetic immigrants from the Northern and Western States. This immigration is now taking place, and it is growing in volume. It would seem as though the West had now been pretty fully exploited; and that the advice to the intending emigrant would henceforth be, for a time at least, "Go South."

THE APRIL SKY.

BY GARRETT P. SERVISS.

The two greatest planets, Jupiter and Saturn, are well situated for observation this month. While Jupiter is slowly sinking in the west, Saturn is rising in the east, and, between 10 and 11 o'clock at night, the observer, with a small telescope, may turn alternately from the belted to the ringed planet and enjoy the striking contrast between them. In comparison with the wealth of detail and brilliant colors exhibited by Jupiter, the globe of Saturn appears dull and uninteresting, but its marvelous rings furnish a spectacular element that more than suffices to counterbalance the attraction of Jupiter's cloud-spotted disk.

Jupiter is in the constellation Cancer, moving slowly eastward. It rises in the middle of the day and is well situated, west of the meridian, during the entire evening. It is better to begin the observation of it with telescopes not later than 8 or 9 o'clock, when it is near its greatest elevation.

Saturn is in Libra, a little east of the star α. It becomes well elevated in the southeast by 10 o'clock P. M.

Mercury, which is in Pisces at the beginning of April and in Taurus at the end, is too near the sun to be observed. It passes behind the sun on the 17th, emerging afterward into the evening sky, where it will become visible in May.

Venus is also too near the sun for convenient observation, although early risers may catch sight of it before sunrise in the constellation Aquarius, from which, in the course of the month, it will move eastward into Pisces.

Mars also is an early morning star, being situated at the opening of the month in the eastern part of Capricorn and at the end in Aquarius, still nearer the sun.

Uranus is in Libra, six or seven degrees southeast of Saturn, and Neptune is in Taurus, near the star ι.

The moon passes the planets in the following order: Mars, in the morning of the 8th; Venus, in the evening of the 10th; Mercury, in the afternoon of the 12th; Neptune, in the morning of the 17th; Jupiter, in the afternoon of the 20th; Saturn, in the morning of the 28th; and Uranus near midnight of the same date.

At the time of the conjunction with Jupiter, on the 20th, the moon will be near first quarter, and the conjunction will occur a little more than half way from the eastern horizon to the meridian. If the sky is clear, it should be possible to find the moon easily with the naked eye. A telescope directed to the moon at about 3 P. M., and swept carefully toward the south, will enable the observer to pick up Jupiter by daylight—a very interesting observation for an amateur. The planet, at that hour, will be about two degrees from the moon, in a southerly direction.

New moon this month occurs about 20 minutes after 11 o'clock on the night of the 12th; first quarter about 15 minutes before 6 o'clock in the evening of the 20th; full moon at 8:47 A. M. on the 27th, and last quarter (the last of the preceding month's moon) at 7:24 P. M. on the 4th.

The moon will be in apogee in the night of the 10th and in perigee in the morning of the 25th.

Jupiter's satellites will present an interesting series of phenomena on the night of the 15th. Before 7:19 P. M., Satellite II will be crossing the planet's disk, moving off the western edge at the time mentioned. At 9:17 P. M. Satellite I, which will previously have been observed drawing near to the eastern edge of Jupiter, will pass upon the disk. At 9:50 P. M. the shadow of Satellite II, which will have been upon the face of the planet since about 7 o'clock, will pass off the western edge. At 10:34 P. M. the shadow of Satellite I will appear on the eastern side of the disk, the satellite itself being at that time about half way across. At 11:37 P. M. Satellite I will pass off the western edge, and one hour and seventeen minutes later its shadow will follow it off the disk.

The starry heavens are very attractive in April. Between 9 and 10 P. M., about the middle of the month,

Sirius is flashing near the western horizon while the brilliant Vega is rising in the northeast.

Nearly overhead shines the Great Dipper, and south of it appears the softly twinkling Berenice's Hair. East of the latter is Arcturus, a royal star in brightness and color, while between Arcturus and Vega glitters the pure white Spica in the constellation of the Virgin.

Among the easily observed double stars now favorably placed are γ Virginis, ϵ Boötis, Mizar in the middle of the Dipper's handle, γ Leonis, and Castor, the great double in Gemini.

THE CONTEST BETWEEN SHOT AND ARMOR.

At the present writing it looks as though the superiority of shot over armor was proved, and that unless some new method of treating the plate be devised, the gun will have the armor at its mercy. That is to say, it will at the proving grounds; whether the hazard and confusion of a sea fight will very often afford the ideal conditions for penetration is open to question. The twelve inch side armor of the two Chinese battleships, which bore the brunt of the Japanese attack at the Yalu, was struck repeatedly; and yet no shot made a deeper penetration than four inches, although the three leading Japanese ships were armed with a gun—the 66 ton Canet rifle—which was credited with the highest power of penetration of any in the world. It is certain that, during the many hours that the fight lasted, some of the shots from these big guns must have struck the armored portions of the Ting Yuen and Chen Yuen. Judged by proving ground results, any one of these shots should have easily penetrated the belt, and wrecked the "vitals" of the enemy.

Now all this goes to show that the gun versus armor contest must not be judged from the results at the target alone. In target firing the gun has everything in its favor. The range is accurately known; the target is stationary; and the shot is delivered normal to the face of the plate. In a sea fight the range is uncertain; the target is moving; and the face of the armor will very seldom be struck squarely by the shot—this last being an element in favor of the armor of greater value than is generally supposed. To this, we think, more than to any other cause, must be attributed the surprising powers of resistance shown by the out-of-date armor plates of the Chen Yuen and her mate.

The history of the development of armor plate dates from the Crimean war and the war of the rebellion. In its earlier stages, the advantage lay with the armor. Penetration was comparatively rare; and in the attacks upon the Russian forts in the Black Sea, and upon the Southern batteries, the side armored vessels proved comparatively invulnerable to the round shot and shell of that date. The gun crews on the floating batteries suffered, as a rule, no greater inconvenience than the rattle of the round shot as it fell harmlessly from the iron plated sides of the vessel. Even the great 15-inch shot from the Rodman smooth bores could not get through. For a while, iron armor held the field. Then came the so-called conical shot, the long rifled gun, and the resulting increase in velocity; in the presence of which the thin plates of iron proved to be helpless.

Armor plate makers tried the next natural expedient, and made the plates thicker; and, as these plates were successively penetrated, they kept adding to the thickness until, in 1881, when the British Inflexible was floated, she carried no less than two feet of solid iron upon her sides. Difficulties of manufacture and the excessive weight of such armor led to the adoption of steel in place of iron. Here, however, the brittle nature of the steel presented a difficulty, and an attempt was made to combine the hardness of steel and the toughness of iron in what is known as the compound plate. This consists of a plate which is made up of an extremely hard steel face upon a softer iron backing. The idea of this device was that the steel face would provide the resistance to penetration; and that the iron backing, upon which the steel was welded, would prevent the steel from cracking; or, should it be cracked, it would keep it from falling to pieces.

The theory was plausible; but the results obtained in trial have been very disappointing; the steel face cracking and flaking off from the backing in most alarming fashion. The failure of the compound plate left the field open to the "all steel" advocates, and for the manufacture of a perfect plate there was only wanting some process by which the steel could be toughened without losing any of its hardness. This process was found in the nickel steel armor, in which the introduction of a proper percentage of nickel gave a remarkable toughness to the steel, without impairing its resisting powers. Shots were put through the test plates without producing those radiating cracks which at the second or third penetration had resulted in complete demolition.

Meanwhile the gunmaker had not been idle. Increased length and smokeless powders resulted in increased velocities; the penetration per ton of gun grew steadily larger; and the thickest steel plates succumbed to a caliber of gun which a few years before would never have been thought of as capable of piercing heavy armor.

The victory now lay with the gun.

It was reserved for an American inventor, whose name will forever be famous in the annals of the armor plate industry, to introduce a process which turned the tables entirely, and placed the advantage strongly on the side of the plate. The Harvey process, which is named after the inventor, seeks to present intense hardness of face, rather than thickness of metal, to the shot. The inventor realized that it was useless to attempt to resist the enormous momentum of modern ordnance; and that the only way to meet that momentum was to break up the material of the shot at the moment of impact. This he accomplished by making the face intensely hard, so hard, indeed, that it was capable of cutting glass. The Harveyized plates were a success from the very first. Shots which theoretically should have easily passed through a plate flew to fragments at the moment of impact.

For some few years the new plates remained practically impregnable against the hardest projectiles. Various systems of shot hardening have been tried, but with limited success; and it is only within the past few months that the gun makers have been able to regain their old ascendency. The first whispers of successful penetration came from Russia, where shot, which had been made on a "secret process," were reported to have passed through Harveyized plates without breaking up. What the process was can only be surmised; but the recent remarkable tests at the United States proving grounds at Indian Head make it probable that some form of what is known as the "soft steel cap" was used on the projectiles.

In these tests, and also the tests at the same grounds last October, the successful shot were "capped," that is to say, the point of the projectile was covered with a soft steel cap. The theory of this device is that when the point of the shot strikes the plate it will be prevented from flying apart by the surrounding metal of the cap. When the point has once entered the hard face of the armor, it is held together by the metal of the plate itself, and the shot can then expend the energy of its unbroken mass upon the body of the plate.

In the experiments of October last a Harveyized plate, which had broken up the ordinary 6 inch shot, was cleanly perforated by four 6 inch capped shot. The experiments now in progress with heavier 8 inch and 12 inch shot will be watched with keen interest, and thus the final advantage seems to lie with the gun.

Roentgen Photography.

In a recent Franklin Institute paper, Drs. Edwin J. Houston and A. E. Kennelly gave the following directions for using the ordinary alternating lighting current for X ray work. To the primary terminals of an induction coil are connected leads from a 50 volt alternating current circuit. The secondary of the induction coil connects with a battery of Leyden jars and with the primary of the Tesla coil. The Tesla coil is made by winding about 80 turns of No. 19 cotton covered wire on a glass tube about ¾ inch in diameter. Over this is passed a slightly larger glass tube wound with about 400 turns of No. 31 silk covered wire. The whole is immersed in a jar of resin oil. The Crookes tube is connected to the secondary of the Tesla coil. This arrangement gives the disruptive discharge, which is of increased effect and less likely to injure the tubes. The discharging electrodes of the induction coil are placed about 5 mm. (0·2 inch) apart. To secure sharp images the use of a metal plate perforated and used as a diaphragm is recommended.

Nikola Tesla has continued his experiments on reflection of X rays from different materials, using an angle of incidence of 45° as the most crucial test. Each sample was tried simultaneously as to its power of reflecting and transmitting the incident ray. Zinc, mica, tin and lead were the best reflectors. Aluminum reflected no appreciable portion of incident rays. There was no corresponding order in transparency to the rays. Zinc, tin and lead proved opaque; mica transparent. He upholds as his view that the X rays are both cathodic and anodic. He has obtained good results by using a zinc reflector for his tubes. He announces that he has not found the least evidence of refraction.

MM. Darien and De Rochas have tested an eye, which was placed upon a plate holder with two fingers beside it. The X rays were then produced and a photograph taken. The eye proved intermediate in opacity between bone and muscular tissue. The rays passed axially through it.

A very interesting line of work has been initiated by Mr. H. I. Dreschfield, L.D.S., of Manchester. He used X ray photography to show the development of the second set of teeth in a living subject, a boy about thirteen years old. He succeeded in obtaining a photograph showing the first set of teeth in place and the second set still in situ in the bone back of and above the others.

It is definitely stated that X rays were used in Vienna to determine whether a wrapped mummy contained the remains of an ibis or of a human being. The process showed it to be the mummy of an ibis.

A very ingenious attempt to measure the intensity of the X rays is due to Prof. R. A. Fessenden and Prof. James Keeler, Western University, Pittsburg, Pa. They immerse the ends of two terminals of a circuit in paraffin, the ends being about one-half inch apart. The X rays are then caused to pass through the paraffin and their effect in causing an electric discharge to pass is used as a measure of their intensity.

Prof. Rowland, of Johns Hopkins University, and Elihu Thomson both appear as enunciators and upholders of the hypothesis that X rays are of the anodic order, and not of the cathodic order. Thomson found that no X ray effect could be obtained from an excited tube when the anode and a fluorescent screen had a patch of opaque metal interposed upon the glass of the tube between them, although the cathode was unscreened. Anode rays he found to be erratic in distribution from the anode, and to require very high exhaustion for their production. He says that it is fortunate for science that the Crookes tube used by Roentgen had a high enough vacuum to give anodic rays.

Cost of Bad Roads.

According to statistics collected by the office of Road Inquiry of the Department of Agriculture, the amount of loss each year by bad roads of the country is almost beyond belief. Some 10,000 letters of inquiry were sent to intelligent and reliable farmers throughout the country, and returns were obtained from about 1,200 counties, giving the average length of haul in miles from farms to markets and shipping points, the average weight of load hauled and the average length per ton for the whole length of haul. Summarized, it appears that the general average length of haul is twelve miles, the weight of load for two horses 2,002 pounds, and the average cost per ton per mile 25 cents, or $3 for the entire load.

Allowing conservative estimates for tonnage of all kinds carried over public roads, the aggregate expense of this transportation is figured at $946,414,000 per annum. Those in a position to judge calculate that two-thirds of this, or nearly $631,000,000, could be saved if the roads were in reasonably good condition. At $4,000 per mile a very good road can be constructed, and if an amount equaling the savings of one year were applied to improving highways, 157,000 miles of road in this country could be put in condition. The effect of this would be a permanent improvement, and not only would the farmer be astonished in the sudden reduction in his road tax, but he would also wonder at the remarkable falling off in the cost of transportation. He would also find that he required fewer horses and less feed for them. He could make two trips to market a day instead of one, when ability to get his goods there at a time when high prices are ruling is a matter of great consequence. Farmers are beginning to apply a little simple arithmetic to some of these matters, and it is not too much to expect that in the near future we shall see a decided revolution in the condition of our rural highways.—New York Recorder.

Value of Farm Animals.

According to statistics published by the Department of Agriculture at Washington, says the Iron Age, the aggregate value of farm animals in the United States has declined very materially in recent years. At the present time the value of these animals is $755,580,597 less than it was in 1893. The decline is more particularly observable in the case of horses. Taking the seven years from 1890 to 1896, it is shown that horses increased in number until 1893. In 1893, however, their value began to fall off, and in 1895 it was not quite half that of 1892, showing an aggregate decline in this respect of about $500,000,000. This depreciation is attributed in the main to the introduction of trolley cars and bicycles. The high cost of fodder, however, after recent seasons of drought, is also given as a contributing cause. The value of mules since 1890 has fallen nearly $80,000,000, or not far from half the total existing value of these animals in the United States. On the other hand, milch cows have increased in numbers, while the average value of these animals has advanced steadily within the past few years. The increase in the value of milch cows last year, as compared with 1894, is $1,300,000. Oxen and other cattle decreased in numbers more than 2,000,000 in 1895, while their value increased on an average $1.80 a head in the same period. A decline is noted in the numbers and value of sheep in the last three years, the decrease in value aggregating about $60,000,000 and the falling off in numbers of these animals last year being nearly 4,000,000. Swine, in 1895, declined 3 per cent in number and 15 per cent in aggregate value, the total decrease in the value of swine in 1895 being nearly $33,000,000. It is expected, however, that the enormous corn crop of last year will have a favorable effect upon the next statement of farm animals, the tendency to an increase in numbers and value being already observable.

AN IMPROVED PACKING.

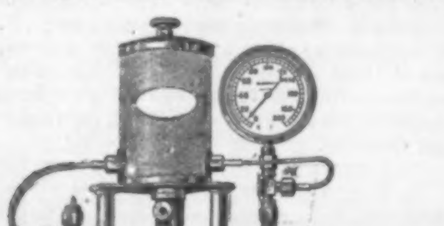
The illustration represents a packing in which a loose portion or flap engages and has a binding or conelike action on the rod, the other part forming a baffle space for the steam, to confine and prevent it from escaping. The improvement has been patented by James Walker, of James Walker & Company, engine and factory furnishers, Lion Works, Love Lane, Shadwell, London, England. The packing is made in a

WALKER'S ROD PACKING.

variety of forms, a few of which are shown in the small figures, and is preferably composed of asbestos, asbestos wire cloth, canvas cloth, hemp, vulcanized fiber, wire gauze, sheet metal, etc., proofed to resist the action of steam or chemicals and folded into alternate or bellowslike layers. In one of the preferred forms the packing is folded to assume a subtantially rectangular cross section, while a flap or loose portion is left narrower than the thickness of the main part and forming a baffle space. The folds of the packing are held together by rivets, which in some cases have enlarged heads on the wearing side of the packing, adding to its durability. Spring plates are also in some cases used to lend resiliency to the flaps, and the strips of metal may be wound into the parts or folds of the packing, the whole tending to produce a packing having a maximum degree of tightness and a minimum of friction.

PROFESSOR DEWAR'S APPARATUS FOR LIQUEFYING AIR AND OXYGEN.

We illustrate below an interesting piece of apparatus for producing low temperatures, made by Messrs. Len-



PROFESSOR DEWAR'S APPARATUS FOR LIQUEFYING AIR AND OXYGEN.

nox, Reynolds & Fyfe, Rosebank Works, Fulham, and which is the outcome of many experiments carried on at the Royal Institution for the last three years. It is designed to reach the lowest temperatures hitherto attained, and embodies principles which, although thought by many to be new, have in reality been used by Professor Dewar in his large apparatus for the past five or six years. This little cooling plant requires no mechanical power, and is specially suited for laboratory use. It consists of two parts, viz., the refrigerator proper and two cylinders of compressed gases. The action is as follows: Liquid carbonic acid from one of the cylinders is ejected into a chamber, and cools a coil through which compressed air or oxygen from the other cylinder, at a pressure of 100 atmospheres or 150 atmospheres, is passed into what is now called a regenerating coil. At the bottom of this coil is a valve, peculiar in its construction, which expands the cooled gas into a vacuum jacketed vessel. The cooled gas then passes back over the regenerator, cooling the compressed gas below its critical point. The gas then commences to liquefy as it passes the valve.

Everything in such an apparatus depends on absolute isolation, or more heat will leak in than the small volume of gas used can take out; thus it is necessary to use vacuum vessels and to carefully proportion all metal parts. This apparatus, which was described by Professor Dewar before the Chemical Society, on January 19, is capable of producing 4 oz. of liquid oxygen at atmospheric pressure and a temperature of −180° Cent. in from 25 to 30 minutes. We are indebted to London Engineering for the cut and particulars.

Egyptian Cotton.

A recent report of the United States consul at Cairo draws attention to the steady increase in the amount of cotton shipped from Egypt to the United States. This has risen from 3,815 bales in 1885-86 to 50,000 bales—Egyptian bales of 750 pounds—equal to 75,000 American bales of 500 pounds weight.

To those who are not acquainted with the industry this looks like "shipping coals to Newcastle;" but as a matter of fact, owing to certain peculiarities of soil and climate, the Egyptian cotton has a fiber of extra length, which renders it indispensable in certain branches of manufacturing which have sprung up in the United States. The staple cotton from the Nile delta, varying from 1 inch to 1½ inches in length, is "matchless for fine threads where strength and luster of finish are essential." It is an excellent substitute for sea island cotton, and the report states that it can be had at a price so low in comparison that mill owners are venturing upon special manufactures hitherto controlled by British mills. Moreover, when it is mixed with American cotton, the latter can be put to a much more extended use.

The report further says: "That long fiber cotton is the staple of the future, is proved by the important value placed upon that of the Nile country by every manufacturing nation of the universe. The demand for it is growing with astonishing rapidity, and overproduction is an unlikely contingent. It seems to me that American agricultural genius should be exerted in order that our Southern States might give Northern and European spindles any and every staple required for finding a profitable market. Egypt is producing more and more cotton each year, and adding vastly to its cultivable area, every acre of which presumably will be devoted to cotton."

In addition to the 44,554 bales shipped in 1894-95 to the United States, Great Britain took 276,294 bales, Russia 132,309 bales, Austria 54,457 bales, France 46,242 bales, Italy 43,808 bales, Spain 19,007 bales, and minor shipments brought up the total to 639,582 bales of 750 pounds weight. This would be equal to about 1,000,000 American bales.

Ordinarily the Nile cotton fetches about two cents a pound more than the United States quotation; but land is costly, varying from $100 to $175 an acre, and rentals are enormous. Moreover, the Egyptian planter is taxed to the extent of $6 to $8 per acre, and he has to pay from 12 to 15 per cent interest on borrowed capital. From all which it is evident that the profits must be less than would at first be supposed. At the same time we learn that "gilt edge" cotton is "supporting the Egyptian government, paying the interest on the enormous debt owing to European creditors, and bringing $60,000,000 in ready money this season to a country that feeds itself, and exports cereals enough to keep a million more people."

It is suggested that seed should be purchased at the ginning establishments in Egypt and shipped to the States for experimental purposes; and that some of the bottom lands of the Mississippi Valley, and of the Brazos district in Texas, might offer analogous conditions, and be made to produce a fiber equal in quality, if not in quantity.

Seven-eighths of the cotton seed goes to England, as there are very few oil mills in Egypt, and what there are have an obsolete equipment. The great cost of freighting the seed would be saved by the establishment of mills on the spot, and the situation presents a promising opening for American up-to-date machinery and methods.

The Orient Steam Navigation Company, Limited, propose to send one of their steamships of about 4,000 tons gross register to Vadsö, in the Varanger Fiord, Lapland (about 30° E. long.), to enable observations to be made on the total eclipse of the sun on August 9.

PRATT'S CONE BELT SHIFTER.

The cone belt shifter shown in accompanying illustration is very simple and easily applied in all places where cone pulleys are used. It is quick and effective in throwing belts from one cone to another. The cut represents the shifter applied to a lathe in connection with a belt which is perpendicular or nearly so. For horizontal or inclined belt a special shifter is made, and when the shipper rod of the countershaft is at the front, different sockets are used.

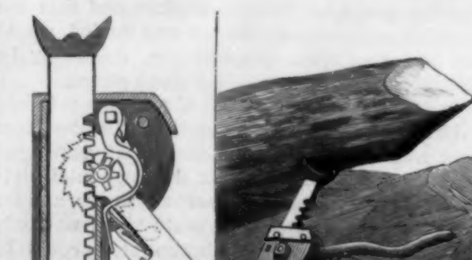
Further information with regard to this belt shifter may be obtained by addressing Chandler & Farquhar, 38 Federal Street, Boston, Mass. A large number of these belt shifters are in use by many of the leading

PRATT'S CONE BELT SHIFTER.

manufacturers in this country, and we understand they are giving excellent satisfaction.

A NEW LOGGING JACK.

The illustration represents a simple and easily operated logging jack, to facilitate the handling of logs without danger to the workmen. It has been patented by John E. Gilchrist, of South Bend, Washington. The casing of the jack has a foot with lip carried all the way around, to enable the logger to take a side or other lift as desired, the casing being made completely of steel, and having a ring in one side to facilitate moving the jack about. The lifting rack sliding in the casing has at its upper end a head turning on a pivot, and the teeth of the rack, as shown in the sectional view, are in mesh with a pinion on a transverse shaft on which is a ratchet adapted to be engaged by a pawl fulcrumed in a lever which has a hooked end engaging the transverse shaft. The pawl is pivotally connected with a hand lever at one side of the working lever, a spring on the latter holding the pawl normally in engagement with the ratchet wheel. A dog engages the ratchet wheel to hold the load in raised position during the up or return stroke of the working lever, a gravity arm normally holding the dog in mesh with the ratchet wheel. The operator lifts the load by swinging the working lever up and down, and to lower the load, the gravity arm is moved to lift the dog out of engagement with the ratchet wheel; but if it is desired to suddenly lower the load or turn the lifting rack, both the gravity arm and pawl are swung outward to disengage the jack and the pawl from the ratchet wheel. The working parts are under perfect control of the operator, and there is no danger to the workmen when raising and lowering loads.



GILCHRIST'S LOGGING JACK.

A DOG BICYCLIST.

We reproduce herewith a photograph representing a Scotch Gordon dog of pure breed accompanying his master upon a tandem bicycle. The dog is here simply a tourist that rides on the bicycle only on a level and during descents. In going up hill, he trots alongside of the machine. Our bicycle readers who have dogs might turn their attention to such training of their animals, for whose convenience a small and well balanced seat might be attached to the machine.—La Nature.

DOG TRAINED TO RIDE ON A BICYCLE.

The Lowest Temperature of Luminescent Visibility.

A new determination of the lowest temperature at which a hot body becomes visible is published by Signor Pettinelli, in the Nuovo Cimento. He heated a cast iron cylinder 30 cm. long and 14 cm. broad in a wrought iron jacket, over a Bunsen burner, to a temperature of 460° C., as indicated by an air thermometer, and then observed its flat end in a dark room from a point 60 cm. above it. When it had cooled to about 115° the red heat vanished and gave way to an indefinite hazy glow. This glow completely disappeared at 404°, and repeated observations gave an error of only 3°. High emissive substances, such as the mantles made by Auer and others for incandescent gas lighting, became visible at the same temperature, but reflecting surfaces had to be heated 20° higher before they appeared to the eye, and glass still more. These low temperature rays were found to traverse glass and water like ordinary light rays, but they suffer a comparatively greater absorption. Different eyes differ slightly in their capacity for seeing them, the maximum divergence being about 6°. But the extent of surface must be the same. Signor Pettinelli found that if he screened off all but one-fortieth of the surface, the body had to be heated 6° higher than before to become visible.

A NEW MOTOR CYCLE.

Inventors have for a long time been working on the problem of the propulsion of bicycles without the aid of muscular power. Unlike the motor carriage the advantage of the motor cycle cannot be so easily demonstrated, for bicycle riders use their wheels very largely for exercise and for the pleasure in riding, and anything in the way of power propulsion would not be received with favor by them.

There is, however, a class of people who would welcome the advent of a practical motor cycle, as it would enable them to prolong their excursions and would eliminate the element of fatigue.

We present an engraving of an experimental motor cycle, built by Nelson S. Hopkins, of Williamsville, New York. The motor is heavier (it weighs 12 pounds 4 ounces) than would be ordinarily required for use on a bicycle. Mr. Hopkins has succeeded in building a motor which will propel a wheel and rider over moderate grades, and weighs only 8½ pounds.

HOPKINS' GASOLINE MOTOR CYCLE.

The motive power is derived from gasoline which is contained in an aluminum reservoir which is strapped to the upper part of the diamond frame. From the reservoir the gasoline is conveyed to the carburetor by means of a small pipe. A valve limits the quantity of the gasoline which is admitted to the carburetor. This valve may be operated from the saddle by means of a rod. The valve stops and starts the motor and regulates the speed. From the carburetor, where the vapor of the gasoline has been mixed with air, the mixture is drawn into the compressor and is then forced into one of the two explosion cylinders, where the charge is ignited by an electric spark, contact being controlled by the movement of the piston. The use of two cylinders makes it possible to obtain an impulse at every turn of the shaft and by means of gears the wheel is propelled with great freedom from jerkiness and vibration. The battery is placed under the saddle in a tool bag, and the spark coil is fastened to the diamond frame, but in later experiments both the battery and coil have been carried in the tool bag.

At the back of the shaft is a small steel gear wheel, which runs with a larger one of phosphor bronze secured to the hub of the wheel. This large gear wheel is movable, and it is arranged so that the motor can be entirely disconnected from the running gear, thus allowing the wheel to be propelled in the ordinary manner. The feet are rested on coasters or on the pedals. Usually the chain is thrown out of gear by the aid of the clutch, but in hill climbing both the motor and pedals are used to propel the bicycle.

It is, of course, impossible for the wheel to run without a rider upon it to keep it balanced, and should he fall, the wheel would stop of its own accord. The weight of the motor being on one side, of course, tends to throw the wheel out of balance, but this is remedied by throwing the center of the saddle over a trifle. All the working parts, except the gears, are inclosed.

Human Endurance of High Air Pressures.

A series of interesting experiments as to human endurance of higher pressures than are usually employed in compressed air work has recently been made by Mr. Hersent, the engineer in charge of the new harbor works at Bordeaux, France, where the quay foundations are being constructed by the compressed air system, and we take the following particulars of these tests from Engineering, of London. As the sponge divers descend from 160 to 200 ft. without injury, it was considered that workmen should be able to endure corresponding pressures under the better conditions of an air chamber, and Mr. Hersent therefore formed a commission of doctors to work with him in ascertaining if men could safely sustain a pressure of 70 lb. per sq. in. The test chamber was fitted with windows, a telephone, electric light and a steam coil, by which any desired temperature could be maintained.

Three men volunteered for the tests; one being a regular compressed air workman, the second an occasional workman, and the third a man who had only entered the working chamber on a few occasions. These men were subjected to pressures for a length of time, usually about one hour. The tests were commenced with a pressure of about 28·4 lb. per sq. in., and the pressure increased very gradually, by about 4·27 lb. per day, to 76·8 lb. per sq. in., while the time for the pressure reduction was increased about ten minutes for each 1·42 lb. increase in pressure. The period of compression was also increased, but to a smaller degree, this being of less importance. All three men sustained without difficulty a pressure of 46·9 lb. with a reduction period of 56 minutes. One of the men, being indisposed from an independent cause, was then withdrawn. At 58·3 lb. pressure the man who was used to working in the chamber felt some temporary inconvenience, and at 65·4 lb. his companion, who was not accustomed to compressed air work, had to be withdrawn, as he suffered from pains in the side. There was no trace of paralysis, but it was not considered safe for him to continue the test, which was finished by the first man alone, who sustained a pressure of 71·1 lb. for one hour, the pressure being then reduced in 2h. 25m. When released from the chamber this man took some sulphurous baths, which had cured the pains of his companion, and then underwent the final test, in which the pressure was raised to 76·8 lb. in 45 minutes, continued for an hour, and then reduced to normal pressure in 3h. 3m. The temperature was increased from 56° F. to 68° F. during the compression, maintained at 68° during the test, and then gradually increased to 86° F. during the reduction of the pressure. The man suffered no inconvenience, with the exception of a tingling sensation, which passed away after a short time. It is considered that, if certain precautions are taken, men in good health can sustain a pressure of 76·8 lb. per sq. in., that means should be provided for heating the chamber at will, and that good ventilation should be maintained during the reduction of the pressure.

As it has been proved that the workmen should rest after leaving the air lock, especially after working under high pressures, elevators should be provided to bring the men to the surface. These experiments go to show the practicability of men working under compressed air at greater depths than have yet been attempted.

The greatest pressure thus far used in compressed air work was 52 lb., corresponding to a head of 120 ft., in the East River Gas Company's tunnel. This was the extreme reached on this work. The ordinary pressure was about 45 lb., corresponding to a head of 104 ft. At the Limfjord Bridge, in Denmark, men worked for some time at a depth of 118 ft.

Our Coal Supply.

In the March number of the New York Bond Record is an article on anthracite coal by William Griffith, which seeks to answer the questions: "How much anthracite is there, and how long will the supply last?" and "What proportion of the future supply do the various interests control and how much can they ship to market?" Mr. Griffith begins by quoting liberally from an article by President Harris, of the Reading Railroad, on this question, in which Mr. Harris estimated that the original contents of the anthracite fields amounted to about 14,453,400,000 tons, of which 82½ per cent, or about 11,921,400 000 tons, remained to be worked. With a production of 45,000,000 tons a year, this supply would last for 265 years, although Mr. Harris estimated that of the actual coal unmined only 5,960,700,000 tons would probably be actually available, which would shorten the period of use one-half. Mr. Harris said we could have coal for 100 years at the rate of 60,000,000 tons a year. Mr. Griffith, in his article, which is an elaborate one, accompanied by long tables and detailed maps, works out estimates on a basis of his own. He gives a tabulated estimate of the approximate future supply of the railroads entering the Wyoming region. He claims that Delaware & Hudson's supply, at the rate of 1895 shipments, will last 26 years; Ontario & Western's, 9 years; Erie Railroad's, 21 years; Susquehanna & Western's, 18 years; Pennsylvania Coal Company's, 54 years; Lackawanna's, 51 years; Lehigh Valley's, 57 years; Central New Jersey's, 124 years; Pennsylvania Railroad's, 52 years. The grand total of unmined coal in the Wyoming region he estimates at 1,278,130,750 tons, with a duration of 52 years. The table gives no figures as to other coal fields.

The Annual Reception of the New York Academy of Sciences, March 26.

BY E. O. HOVEY.

The third annual reception of the New York Academy of Sciences, which consists mainly of an exhibition intended to illustrate recent progress in all branches of science, was held Thursday afternoon and evening, the 26th of March, in the American Museum of Natural History. The afternoon session was intended especially for the teachers and advanced pupils in the schools and was informal in its character. In spite of the unpleasant weather, the evening session was very largely attended, and the whole affair was pronounced a decided success. The exhibition was very comprehensive in its scope, fourteen departments of science being represented. So much material was displayed that it was impossible for a person to get even a general idea of what was to be seen and studied, and our report can deal with only a few of the most striking features of the exhibition. It seemed to many that it would be well if the academy could arrange to hold the reception two days instead of one, or could have the lecture on a different evening from the main exhibition.

Popular interest evidently centered around the exposition of the Roentgen X rays and their application. Prof. M. I. Pupin, of Columbia University, delivered an interesting and instructive lecture on the subject, illustrated by apparatus, experiments and photographs. One piece of apparatus that he had was Edison's latest invention, the "fluoroscope," which had been received from the celebrated electrician only three days before. This instrument consists of a hopper shaped box, the small end of which is fitted into a hood which is placed over the eyes like the eyepiece of an oldfashioned stereoscope. The large end of the hopper is closed by a flat screen coated with tungstate of calcium, which has been found to be especially susceptible to the fluorescent influence of the X rays. The screen is about ten inches distant from the eyes, and the whole apparatus is thus very compact and convenient. After the lecture many persons in the audience availed themselves of Prof. Pupin's invitation to examine the shadow of the bones of their own hands through the new fluoroscope, a novel experience for every one. This instrument will enable surgeons to examine broken bones, gunshot wounds, etc., by means of the X rays, without the tedious delay and inconvenience incident to developing photographic plates.

In the sections of physics and electricity in the exhibition hall were numerous Roentgen photographs of a great variety of objects, the most striking of which was a life size representation of the hand and forearm of an adult, with every peculiarity in the outline of the bones clearly brought out. The term used by Prof. Pupin for these pictures is "radiographs." Another interesting exhibit in the section of physics was the apparatus recently devised for photographing the human vocal chords while in action and photographs made by it. These photographs show that the cartilages rotate, and thus vary the length of the vibrating portion of the chords.

In the photographic section there was a very interesting series of photographs of lightning. These showed that lightning is wavy, not zigzag in its course. Forked and branched discharges, both natural and artificial, were represented, as well as "thunderbolts." One picture showed how trees are of service during a thunder storm in dissipating, neutralizing or conducting a discharge. Another was of ribbon lightning, which was caught by the camera from the rear platform of an express train at midnight while crossing the prairies of North Dakota. In this section also was a beautiful series of reproductions by the new three-color process of studies from nature and paintings from negatives and plates untouched by hand.

The astronomic exhibit consisted of several pieces of apparatus and of a large number of photographs illustrating the work done at the observatories of Harvard and Columbia Universities and at Allegheny, Pa. At the last place much work is being done toward the solution of the problems of planetary atmospheres and rotation by spectroscopic methods.

Experimental psychology is a science which has taken great strides of recent years, and some most ingenious machines have been devised for use in its investigations. One of these was on exhibition at the reception and excited much popular interest, to judge from the crowd around it watching its operation. The machine is adapted for use with several different mental stimuli, but the color wheel was the only one used on this occasion. The observer looks at the rotating wheel, and, as soon as he sees the given color, he pushes an electric button. The machine registers the instant when the color comes in sight and the instant when the observer responds to the stimulus. It has been found that, as a rule, educated people are more quick to respond than uneducated.

Ethnology and archæology had a large exhibit, mostly from the recently made collections of the American Museum of Natural History. Here were representations of animal forms in pottery, painting, weaving, gold, stone, and wood, in the art of ancient Peru, and portrait heads in pottery of the same time and place. A series of pathological specimens from a prehistoric burial ground in Kentucky showed that both sexes were equally subject to inflammation and suppuration of the bones, the skeletons of nineteen out of fifty-five adults being affected with it. Skeletons exhumed last summer at an Indian burial place at Tottenville, Staten Island, showed a very close relationship between the prehistoric people of that locality and the Indians now living in Nova Scotia. Dr. G. M. West exhibited diagrams which he had prepared which show that children develop differently in different parts of the country and at different times in the same locality. In Worcester, Mass., children grow very tall, especially the boys. In Boston and Toronto both boys and girls are shorter than the average, while in Milwaukee they are a little taller. The diagram of Oakland, Cal., presented a curious phenomenon. At one time the children were all very short, then they began to get taller, and the girls have kept the upward tendency, while the boys fell back again and then took a new start upward. Another interesting exhibit in this section was that of arrow games in Asia and America. By means of many specimens Mr. Stewart Culin showed how playing cards and chess had originated in the arrow. He also illustrated the hypothetical development of the seal cylinder, the Chinese coin and the folding fan.

Next to this section came that of palæontology, and the strange skulls and pictures in it attracted much attention. The pictures formed a series of attempts to put flesh and blood on to the wonderful skeletons which have been found in the extensive Tertiary lake deposits of western North America, and gave one a vivid idea of what the condition of affairs must have been when the uintatherium, titanotherium and hyrachyus (or rhinoceros) dominated the land.

Geology, mineralogy and physiography occupied the north end of the space given up to the academy for the evening. The first contained much matter of great interest to the specialists present, though most people would have passed the whole by as being so many "stones." A suite of specimens and photographs illustrated the mode of occurrence of the ores and rocks in the now famous Cripple Creek, Colorado, gold fields. The ores are fresh or decomposed telluride of gold and are oftenest associated with dikes of igneous rock (phonolite or nepheline basalt), which penetrate the red granite of the Pike's Peak region, or a decomposed breccia of andesite, though they also lie in veins which fill more or less irregular veins in the andesite breccia away from dikes. A series of variegated marbles from Swanton, Vt., showed a beautiful and remarkable variety of colors and markings. Madrid, New Mexico, furnished a suite of specimens of coal showing the change from pure bituminous to pure anthracite, caused by the proximity of volcanic rocks. The display of minerals was very large and contained many unique specimens, as well as samples of rare and new species. The monster tourmaline crystal from One Hundred and Seventy-first Street and Fort Washington Avenue was exhibited, as well as a much larger but coarser crystal of the same mineral from Bethel, Conn.

Specimens of the new minerals, lorandite, northupite and lawsonite, were shown, as well as large quantities of the very strange and heretofore rare mineral thaumasite, which has very recently been found in abundance at West Paterson, N. J. The display of minerals from this new locality was rendered especially noteworthy by the exhibit of A. H. Ehrman, who has the choicest of the material thus far obtained there. In one corner of the mineralogical section Geo. F. Kunz had a booth erected in which, by means of electric light passed through violet glass, he showed that some diamonds are strongly phosphorescent, while most diamonds do not have this property. One of the stones he exhibited emits phosphorescent light for several hours after the original source of light has been shut off. One of the anomalies shown in this section were pseudomorphs of pyrite and turquoise after orthoclase from Cerro de Potosi, Bolivia. The section of physiography was of especial interest to teachers, on account of the newly issued text books, relief maps and models and wall maps on exhibition.

In the botanical department one could see numbers of beautifully mounted preparations illustrating new species of plants and microscopical and other features illustrating recently elaborated life histories and relations of plants and groups of plants. The economic as well as the scientific side of the science was shown in three series of specimens, preparations and drawings used in making a comparative study under varying circumstances of as many plants which are used extensively as drugs, with the object of furnishing means of determining whether the plants had been collected at the proper time or not and whether they were retaining their valuable properties or not.

Persons interested in chemistry were much pleased at the opportunity given in the chemical section of seeing the spectra of the newly discovered elements—argon and helium—as well as the apparatus used in extracting helium from the mineral monazite.

Living things always arouse interest, and the aquaria shown in the department of zoology were always surrounded by crowds of people who seemed perfectly willing to expose their ignorance by the curious questions they asked. One aquarium contained living tube worms and a ship worm, corals, barnacles, a soft clam and some sea anemones. Others had in them paradise fish, the nest building sticklebacks and black dace, fish bred for great eyes, for particular colors and for fantails. The largest single item exhibited in any of the sections was in this of zoology; it was the great Asiatic elephant Tip, of unsavory fame at the Central Park menagerie and elsewhere.

We are apt to think of bacilli or microbes as being harmful things, but that they are not always such was shown in the department of bacteriology by the exhibit of Prof. H. W. Conn. In milk received some time ago from Uruguay he found a bacillus which proves to have a marked power of ripening cream for butter making, improving the flavor and keeping qualities of the butter made by its use.

The section of anatomy had an exhibit which consisted for the most part of series of casts showing variations in the pectoral muscles of man, and comparing them with similar muscles in nine other animals, and showing the development of the sternalis muscle, which is now usually very small and useless, but which in some former stage of life apparently extended all over the chest, and was very important.

The president of the academy this year is Prof. J. J. Stevenson, of the University of the City of New York, and just before Prof. Pupin's lecture on the Roentgen X rays he gave a general survey of recent scientific work, especially that accomplished in the past year. Prof. H. F. Osborn was the chairman of the reception and exhibition committee, while Dr. J. L. Wortman was chairman of the special committee of arrangements. The departments of the exhibition with the men in charge of each were:

Physics, William Hallock and Herbert T. Wade; electricity, M. I. Pupin; photography, Cornelius Van Brunt; chemistry, Morris Loeb and C. E. Pellew; astronomy, Harold Jacoby; geology, J. J. Stevenson; mineralogy, E. O. Hovey; physiography, R. E. Dodge; zoology, William Stratford: bacteriology, T. M. Cheesman; palæontology, J. L. Wortman; anatomy, George S. Huntington; ethnology and archæology, Franz Boas and M. H. Saville; experimental psychology, J. McK. Cattell.

The Hospitals of Florence.

Many institutions now engaged in active charitable work in Florence date their origin from the twelfth and thirteenth centuries, and successive generations of Florentines have carried it on, in many cases without intermission, down to the present day. Hence we find, says the British Medical Journal, bacteriological research and modern methods of treatment, antisepsis and hygiene, carried on side by side with traditional usages in buildings which carry the mind back to early mediæval times. There is not a single modern hospital in Florence; the new hospital for children is without the walls. Among the records of early charitable institutions of Florence are those founded by the Knights Templar and the Knights of the Order of St. John of Jerusalem in the twelfth century. The principal hospital of the present day, Santa Maria Nuova, was founded in 1288, and about the same time the captains of the Bigallo determined to preside over the hospitals in order that the sick should be tended with brotherly love; the captains of Or San Micheli took into their charge orphans, the destitute and widows, and the brotherhood of the Misericordia undertook to transport invalids to the various hospitals, and the dead to their last resting places. This brotherhood is still performing the same work of mercy, and may be daily seen robed in long white gowns which completely cover the head, and are only pierced with eyelet holes, traversing the streets of Florence with their living or dead burdens. In 1340 Villani's history records that there were more than 1,000 beds for the sick poor in Florence. At the end of the fifteenth century there were thirty-five hospitals, some special, some general, and some to give shelter to the destitute. All these institutions were established by the various guilds or privately endowed, and if all the wealth left to Florence had been preserved to its original destination, it is said that half Tuscany would belong to institutions for the relief of the poor. In early days the moneys left to the poor generally reached their destination—a contrast, says Pastarini, with present times, when much of that which was intended for the poor finds its way into the pockets of the employes of charitable institutions. Many of these charities were suppressed by the Council of Regency, in 1750, and many more by Peter Leopold, who wished to centralize public institutions in the state. At the present day most of the hospitals are directly or indirectly under government control.

AN early sign of incipient pulmonary tuberculosis is prolonged expiratory murmur. The respiration is apt to be short and "catchy."

Johannesburg Gold Fields Described.*

It is now a matter of history how Col. Ferreira and party made the discovery of the Johannesburg gold fields by the accidental uprooting of a tuft of grass. Such an unusual occurrence resulting in the discovery of continuous and permanent mineralized lodes or "ledges" will be explained in the following description of the character of the country, etc.:

Journeying westward over an open, treeless, undulating, prairie-like country at the foot of a slightly rising and crested hill to the right and some 5,000 feet above sea level, one travels along the divide of watersheds of that part of South Africa between the parallels 22 and 27 of south latitude, over grassy plains and slopes known as the "high velt" with numerous springs ("fonteins") bursting through the surface every few hundred yards, some to flow northward to the Limpopo and others southward to Vaal River, and suggesting the district name of Witwatersrand (White-waters-range), at this time—a little less than ten years ago—a veritable paradise for game, the habitat of roving bands of springboc, blesboc, koodoos and other species of antelopes, a country better calculated to excite the ambition of the shepherd or stockman than the prospector, there being no distinguishing feature to disturb the general contour of the undulating "high velt," not even the shade of grass or species of wild flowers varied to mark the narrow line, stretching some forty miles from east to west, forming the "main reef series of auriferous lodes" lying hidden a few feet below the surface or any defined outcrop to guide the prospector to the hidden wealth, or to create the least suspicion in his mind that he had been traveling for miles upon his "bonanza." But the accidental revealing of "colors" at the water fontein soon brought into action the prospector's pick and pan, when the source of wealth was discovered to be in the gravelly soil, and at greater depth in compact conglomerate lodes in a quartzose sandstone formation.

In constitution and structure the "main reef series" are conglomerated bodies of waterworn or rounded quartz pebbles, varying in thickness (or depth), separate and parallel, and evidently of aqueous origin, deposited in solution, probably an ancient lake or river bed, moraine or of geyser action, either theory being equally tenable until more positive proof shall have been discovered by future workings. Twelve lodes, or locally called reefs, constitute the series, seven of which are "dead lodes" and five "pay lodes," which vary from one to a few inches in thickness, to one from sixteen to twenty-four feet thick. The order of bedding of the series compasses about 130 feet, measured at right angles, both to the trend and dip of formation. Lithologically the conglomerates (locally called "banket") are composed of quartz pebbles, the fracture having a glassy luster and color subtransparent to a blue opaque, and varying in size from three-fourths inch to two and a half inches in diameter, the matrix, or cement, being composed of granular brecciated quartz, apparently of the same origin as the pebble, but alone forming the mineralized body. I believe the past nine years' operations have failed to discover any gold in the pebble itself. The supposition is therefore advanced that the gold is also of aqueous deposition and subsequent to that of the pebble and matrix. The value of the lodes also varies with the thickness, the thinnest being the richest, averaging $48, and the widest $7 per ton. The milling average for the past year yielded $11.50 per ton.

The character of the ore below a depth of fifty feet from the surface is a solid conglomerate sulphide, becoming more friable and disintegrates under the weathering and oxidizing influences at the surface. The ores are, therefore, free milling and amalgamating for a limited depth, after which concentration and cyaniding is the process most commonly adopted.

The country rock, also a quartzose sandstone and evidently also of sedimentary origin, is considerably disturbed by faultings and intrusive bars and dikes. Running parallel to the main reef series some two miles distant to the south is a low mountain chain of diorite, the major factor of disturbance of formation and dips, from which the various bars or loess at varied angles traverse the formation, which, together with the unequal shrinkage, causes the true continuity of the lodes to be broken and practically dividing the main reef series into sectional parts. Such faultings occur laterally to the lodes and are from a few feet in some instances to some hundreds of feet in others, notably in a property named the Gladstone. The lodes continuing two-thirds the length of this property were lost by faulting, and ultimately discovered nearly 600 feet to the north, and so completely segregating the property into two separate and distinct mines. The dip of the lodes also is very variable at different parts of the series, ranging from fifteen degrees to the vertical, but the general dip may be said to average forty-five degrees, synclinally to the south.

The operations of the diamond drills have been very extensive and have demonstrated the fact that the lodes are continuous to the lowest depth attained, about 4,000 feet vertically, while the "prospects" at this depth are very considerably richer than at the apex of the lodes. The subject of deep levels, therefore, is of critical importance to the mining industry of the "Rand" and forms one of the grievances of the Uitlanders, which they recently attempted to redress by force of arms.

The size of a Transvaal mining claim being 150 feet in direction of lode by 400 feet wide and the right to mine confined to the verticals of either end or side lines, the right of ownership is held upon a "diggers' license," renewable every month at a cost of $5 for this area, and the number of claims held by the mining companies vary from a block of six to one of 186 claims. It is therefore obviously necessary for the mining companies to secure as much lateral area as the dip and practical working depth justifies. This area (locally called bewaarplaatsen) must necessarily extend, where the angle of dip is flat, over many lateral claims of 400 feet each and aggregating in an almost prohibitory annual tax, and an injustice to so important an industry when compared to the mining laws of the United States or Canada. Take for comparison the mines in British Columbia, in which so many citizens of Spokane are interested, and we find that upon the Boers' terms and conditions each British Columbia claim would cost the owners, in diggers' licenses only, no less than $2,246.50 per annum, as against $12.75 per annum charged for the privilege in British Columbia. Also in comparison with the mining laws of this State—Washington; the mining claim is equal in area to fifteen Transvaal claims, with no fixed annual charge following the small fee upon recording. Moreover, the Boers' prohibitory taxation does not stop here, as the government reserves the right to rent, lease or sell the surface area as is seen fit; therefore the mining companies must pay another tax for surface rights covered by the necessary buildings, mining and recovery works, etc., incidental to the industry. The Boer government thereby inflicts a severe penalty upon the Uitlander for encroaching upon his beloved heritage in search of gold, and also takes every possible opportunity to impress his hatred and contempt for a people of this progressive age and civilization.

The developments of diamond drilling operations previously referred to will convey some idea concerning the "life" of the "Main Reef Gold Lode Series" (of which Johannesburg is the center) now being mined for a distance of over forty miles, but for more definite information we will take the annual tonnage of ore now being extracted, viz.: Three and one-fourth million tons, the proved depth (measured with the angle) of lode as 6,000 feet, the average collective thickness of the five pay lodes as twenty feet, the weight of ore at twelve cubic feet per ton, and duducting 15 per cent for faultings, etc., and ten million tons extracted to date, we have for the forty miles "ore in sight" equal to the next 550 years' operations at the present rate.

* By F. G. Jordan, M. and C. E. in Mining, a Journal of the Northwest Mining Association.

Temperatures at Great Depths.

AT WHAT DEPTH AND TEMPERATURE CAN OUR MINERS WORK?

Mr. Agassiz says, for several years past he has, with the assistance of the engineer of the company, Mr. Preston C. F. West, been making rock temperature observations as they increased the depth at which the mining operations of the Calumet and Hecla Mining Company were carried on. They had now attained at their deepest point a vertical depth of 4,712 feet, and had taken temperatures of the rock at 105 feet; at the depth of the level of Lake Superior, 655 feet; at that of the level of the sea, 1,257 feet; at that of the deepest part of Lake Superior, 1,633 feet; and at four additional stations, each respectively 550, 550, 561, and 1,256 feet below the preceding one, the deepest point at which temperatures have been taken being 4,580 feet. They proposed, when they had reached their final depth, 4,900 feet, to take an additional rock temperature, and to then publish in full the details of their observations.

In the meantime they thought it might be interesting to give the results as they stood. The highest rock temperature obtained at the depth of 4,580 feet was only 79° F., the rock temperature at the depth of 105 feet was 59° F. Taking that as the depth unaffected by local temperature variations, they had a column of 4,475 feet of rock with a difference of temperature of 20° F., or an average increase of 1° F. for 223·7 feet. "This," says Mr. Agassiz, "is very different from any recorded observations, Lord Kelvin, if I am not mistaken, giving as the increase for 1° F. 51 feet, while the observations based on the temperature observations of the St. Gothard tunnel gave for an increase of 1° F. 60 feet. The calculations based upon the latter observations gave an approximate thickness of the crust of the earth, in one case of about 20 miles, in the other of 26. Taking our observations, the crust would be over 80 miles, and the thickness of the crust at the critical temperature of water would be over 31 miles, instead of about 7 and 8·5 miles as by the other and older ratios. With the ratio observed here, the temperature at a depth of 19 miles would only be about 470° F., a very different temperature from that obtained by the older ratios of over 3,000° F.

"The holes in which we placed slow-registering Negretti and Zambra thermometers were drilled, slightly inclined upward to a depth of 10 feet from the face of the rock and plugged with wood and clay. In these holes the thermometers were left from one to three months. The average annual temperature of the air is 48° F., the temperature of the air in the bottom of the shaft was 72° F."

Mr. Edward Hull, in his work on "The Coal Fields of Great Britain," made an inquiry into the physical limit to deep coal mining, and he states that in Paris, at an artesian well sunk to 550 yards, the general result in chalk was found to be 1° F. increase for every 60 feet beyond the normal. In Westphalia a similar boring was carried to a depth of 768 yards, and the result was an increase of 1° F. for every 54 feet. Near Geneva an artesian boring gave 1° F. for every 55 feet. At Mondorf, says Mr. Hull, an artesian boring gave 1° F. for every 57 feet, and he gives details as follows:

	Yards.	
Lias	59·15	about.
Keuper	226·08	"
Muschelkalk	156 17	"
New red sandstone	342·60	"
Old schistose rocks	17·22	"
	801·26	"

In the Tresavean mines in Cornwall, Mr. Hull goes on to say, the depth is about 2,112 feet and the temperature was between 90° and 100°; this result would give an increase of 1° for every 56⅛ feet. At the Monkwearmouth Colliery experiments showed an increase of about 1° for every 60 feet. At the Dukinfield Colliery, during the course of sinkings, the thermometer was inserted in a dry bore hole and removed as far as possible from the influence of the air in the shaft, and left in its bed for a length of time varying from half an hour to two hours. The sinkings went down at that time to 2,055 feet. There were also observations made in the open workings at 120 yards from the shaft and at a depth of 2,151 feet. The first of these observations gave 51° as the invariable temperature throughout the year at a depth of 17 feet. Between 231 yards and 270 yards it was nearly uniform at 58·0°; and the increase from the surface, says Mr. Hull, would be at the rate of 1° F. for 88 feet. Between 270 and 309 yards the increase was at the rate of 1° for 62·4 feet; between 309 and 419 yards the increase was at the rate of 1° for 60 feet; between 419 and 613 yards the increase was at the rate of 1° for 86·91 feet; between 613 and 685 yards the increase was at the rate of 1° for 65·6 feet. The result of the whole series of observations gives an increase of 1° for every 83·2 feet.

Mr. Hull adopts 50·5° F. as the standard of departure—or, in other words, as the temperature of no variation at a depth of 50 feet underground—and then adding 1° for every 70 feet beyond the first fifty, and taking into account the increased density of the air, he considers the theoretical increase of temperature at several depths would be found as follows:

Depth in feet.	Increase of temperature due to depth.	Increase of temperature due to density of air.	Resulting temperature.
1,500	21·42	5·0	76·92
2,000	27·85	6·5	84·85
2,500	35·5	8·5	94·00
3,000	42·14	9·83	102·47
3,500	49·28	11·66	111·44
4,000	56 42	13·16	120·08

Mr. Hull did not consider our miners could work at a higher temperature than that of 94°—almost that of the tropics. But he thought it would be possible to reduce the heat even of a mine 4.000 feet in depth to a degree not only tolerable, but admitting of healthy labor, and it was for that reason he fixed the limit of possible coal mining operations at 4,000 feet.—Science and Art of Mining.

NOVELTY in advertising is the thing now. The latest and one of the most humorous schemes has been amusing the patrons of theaters for three or four nights, says a city contemporary, and has succeeded in escaping the notice of managers. A bald headed man is the instrument. On his shining pate is painted in indigo blue the name of a patent medicine. He sits in the front row, and conducts himself with propriety, while people behind him are convulsed with laughter, each observer supposing that here is a practical joke some one has played on an unsuspecting friend.

WHEN dogs, cats, and other animals, carried long distances on cars and steamers, sometimes confined in bags and baskets, can, without asking any questions, find their way home, and birds traveling thousands of miles come back year after year to the same nests, and carrier pigeons to their dovecotes, Our Dumb Animals thinks it is pretty sure that they know some things to a knowledge of which no human being has yet attained. There is a vast field of animal intelligence to be studied, and the more we study, the more we shall be filled with wonder and admiration.

THE ISLAND OF CUBA.

(Continued from first page.)

wood of this tree, which grows in great abundance, being used for the posts and frame of the house.

The celebrated Havana tobacco is grown on the western end of the island, and the choicest quality is raised a little to the west of Havana, chiefly on the banks of the San Sebastian. It is known as the "vuelta abajo" tobacco, and nearly the whole of it find its way to the royal courts of Europe, whose agents have for a long time past been in the habit of buying the whole crop many years in advance. Genuine vuelta abajo cigars will cost $1.25 apiece.

Although there is a certain monotony about the appearance of the lowlands, with their miles of sugar plantation, there is no lack of beauty in the rolling uplands of the interior. These, as will be seen from the engraving, are picturesque and parklike in appearance, though it is impossible for an illustration to convey any impression of the luxuriance of the tropical vegetation or of its brilliant verdure. The grasses are rich, and cattle raising forms one of the staple industries of the country. Coffee is raised in considerable quantities, and the land produces annually two crops of Indian corn, which is the chief cereal of Cuba. The principal fruits are oranges, pineapples, plantains, bananas, and melons. The general agricultural industry, however, whether it takes the form of fruit or general farming, is in an undeveloped condition.

UNLOADING SUGAR CANE AT THE PLANTATION MILL.

THE AVENUE EL PRADO—TYPICAL ARCADE IN THE BUSINESS PORTION OF HAVANA.

The forests of Cuba form one of its most striking natural features. They are estimated to cover fully two-thirds of the total unreclaimed land, or some 12,000,000 acres in all; and they are so dense as to be almost impenetrable. They are made up largely of hard woods, such as mahogany and the Cuban ebony, and a certain amount is cut down for export. The most valuable growth in the Cuban forests is the palm, of which the most common species, the Palma real, is found throughout the whole island, but more particularly in the western half.

Cuba possesses the usual wet and dry seasons of the tropics, and the range of temperature is very small, varying between 87° in the summer and 72° in the winter. There is no snow, and the frosts are confined to the higher altitudes of the mountains. The best time to visit the island is from the first of November to the first of April, or during the dry season, when the climate is a delightful one. During the rest of the year, however, the season is not healthy for foreigners. The rains are positive cloud bursts, and the country roads are rendered all but impassable.

The cities of Cuba are fully as picturesque in their way as the surrounding country. By far the most important of these is Havana, which is the capital and the chief seaport of the island. It is admirably situated, both for military and commercial purposes, on the shores of a land-locked harbor, the entrance to which is narrow and tortuous and defended by two forts, known as the Moro and the Punta castles. The most celebrated of these is Moro Castle, which is situated on the northeastern side of the entrance. It is in the courtyard of this fortress that many a Cuban patriot has suffered death for his country.

The harbor is one of the finest in the world, and could float a thousand ships of the largest size. Unfortunately, it is being contaminated by the discharge into it of the whole of the sewage of Havana, and, as there is not sufficient scour of the tide to carry it out to sea, the filth is constantly accumulating. The result will certainly be disastrous to the city, unless some system of direct drainage to the sea be carried out.

In many respects Cuba is behind the age, and on arriving there the first evidence of this is seen in the methods of discharging freight. Although there is an ample depth of water alongside, the ships lie out at some distance from the docks, and the cargo is discharged into lighters. All this expense and delay is incurred in order that the customs duties may be gathered in full. Immediately upon landing, the visitor is impressed by the strange novelty of the city and its inhabitants. There is a romantic air of mediævalism about the older quarters of the city; he is at times conscious of having taken a step backward in the march of civilization, and the romantic impression is deepened by the soft, dreamy atmosphere of the tropics and the sweet odor of tropical vegetation. At the same time the more modern portion of the city is well built, and presents a dignified and harmonious appearance. The Spanish influence is everywhere apparent, and a modified classic architecture prevails. The business block on the Avenue El Prado, which we have chosen for illustration, shows the general appearance of the best streets of Havana. It will be noticed that the front of the block abuts directly on the street and that the sidewalks are built beneath continuous arcades, which are open to the street, and have the stores located beneath their shelter. Architecturally, the effect is very pleasing, and they form a welcome protection from the excessive heat and heavy rains of the summer season. The houses are built chiefly of stone and then plastered, this latter work being of a good finish and durable quality. The business people live over their own stores, the two upper stories being used for domestic purposes. The entrance to the better class of homes is often freely decorated with Moorish colored tiles, and stenciling is employed with good effect upon the outside walls.

In the older quarters the streets are narrow and very tortuous and the houses only one story in height. There are no sidewalks to speak of, and as the great heat necessitates the windows being kept continually open, they are protected by the prison-like iron gratings which are seen in the illustration. The interior of a Cuban home, even among the better classes, is very simple in its appointments. The excessive heat and the prevalence of insects necessitate the use of as little furniture as possible, and no hangings or draperies are to be seen.

The street scenes are novel and often ludicrous, as when, for instance, the milk seller drives the cow and calf (the latter muzzled) up to the door and milks the amount of his purchase in the presence of the customer and literally at his doorstep. The favorite luxury is "barquillo," a thin cake made of flour spiced with cinnamon. The barquillo vender goes through the streets beating a quickstep march on a musical triangle.

Havana is not as yet wrestling with a "rapid transit" problem. Travel is mainly carried on in "volantas," which are hired at the rate of 20 cents for the trip. Whether the trip be for two or three blocks or the whole length of the city, the price is the same. The city possesses a cathedral of moderate proportions, whose interior is rich in frescoes and colored marbles. In the wall of the chancel a medallion with an inscription marks the resting place of Columbus. The Tacon Theater, seating 3,000 persons, has witnessed the performance of some of the finest operas in the world, for the Cubans are lovers of music and the drama. The

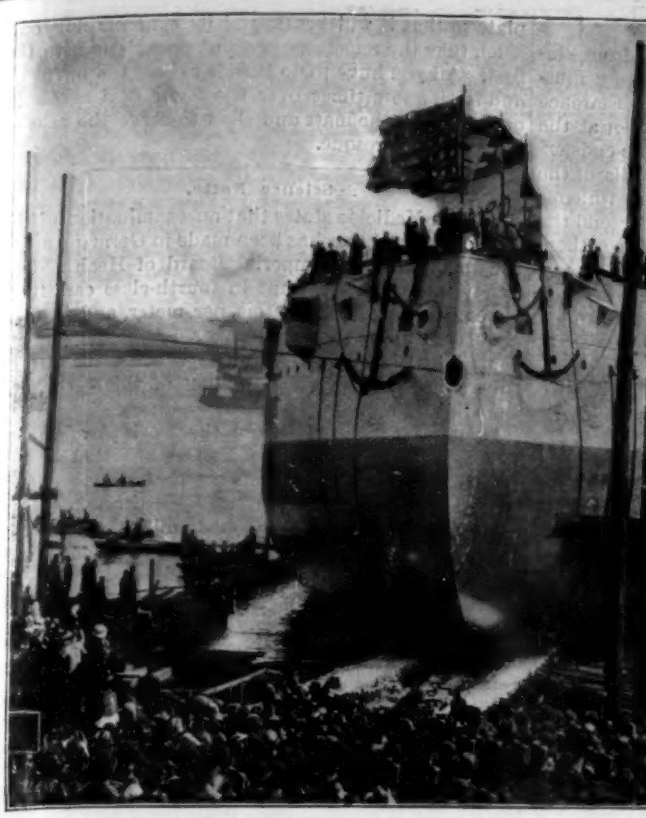
NARROW STREET IN THE OLD QUARTER, HAVANA.

various promenades, drives and gardens are exceedingly fine, and no visitor should miss seeing the botanical gardens and palm tree avenues of Los Molinos.

It is difficult to get an exact estimate of the population or the relative proportion of its different elements. It is broadly divided into the Insulares or native Cubans of Spanish descent, the Peninsulares or imported Spanish element, which is made up mainly of office holders, merchants and speculators, who do not and never intend to make Cuba their permanent home, and lastly the mixed races, such as the mulatto, negro and Chinese. It is roughly estimated that there are 1,000,000 residents of Spanish extraction, 500,000 colored people and 50,000 Chinese coolies.

THE LAUNCH OF THE SEAGOING BATTLESHIP IOWA.

On March 28, at 1:14 P. M., the seagoing battleship Iowa was launched at Cramps' yard in Philadelphia. The occasion was a memorable one, as it marked the most important step in the addition to the United States navy of a ship the first of her class in our navy, and a vessel destined to be one of the most formidable men-of-war afloat. Hitherto she has been officially known as "Seagoing Battleship No. 1," her number indicating the newness of her type. Our battleships up to the present day have been designed for coast service and have been designated as coast line ships. But the Iowa, while in armor and armament a battleship, is somewhat lightened and is very materially modified as referred to her predecessors, so as to be capable of prolonged sea service. She partakes of the qualities of such a ship as the cruiser New York together with those of the typical battleship.



Photographed and copyrighted, 1896, by W. H. Rau.

LAUNCHING OF THE IOWA.

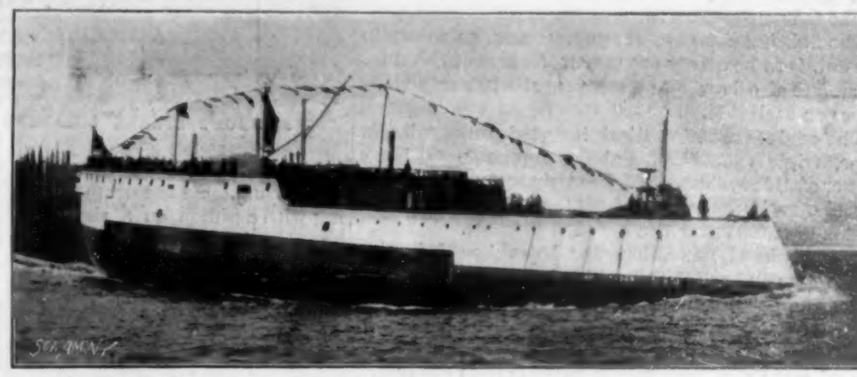
The launch, which was a most successful one, was attended by a very large assemblage, including a party of representative statesmen from the State of Iowa and one from the national capital. Many other distinguished guests were present. At the bow was erected the launching platform, which was occupied by the Secretary of the Navy, the Governor of the State of Iowa, and others. Miss Mary Lord Drake, daughter of the Governor, was appointed to break the traditional bottle of champagne upon the bows of the ship as she started, and to name her Iowa. All went smoothly. Our cuts show two views of the launch. In one the bow of the great ship is toward the spectator and her stern is just taking the water. To the left of the view is seen the party on the platform, among them the lady sponsor of the ship. The other cut shows the side view of the ship as she took the plunge. The wave thrown by the stern is specially to be noticed. On the side is a long dark rectangular space. This marks the protected region of the ship. This area is to receive the heavy side armor of 14 inch nickel steel. Both views are reproductions of photographs taken under unusually favorable auspices. In her descent down the ways the ship is calculated to have made almost exactly her contract speed of 16 miles per hour.

The following are the principal dimensions of the Iowa:

Length on load water line	360 feet.
Extreme breadth	72 " 2½ inches.
Moulded depth	39 " 4½ "
Mean draught	24 "
Displacement	11,296 tons.
Indicated horse power	11,000
Coal bunker capacity	2,000 tons.
Speed in knots guaranteed	16

For each quarter knot in excess of the above speed, as shown in a four hour sea trial, a bonus of $50,000 will be paid.

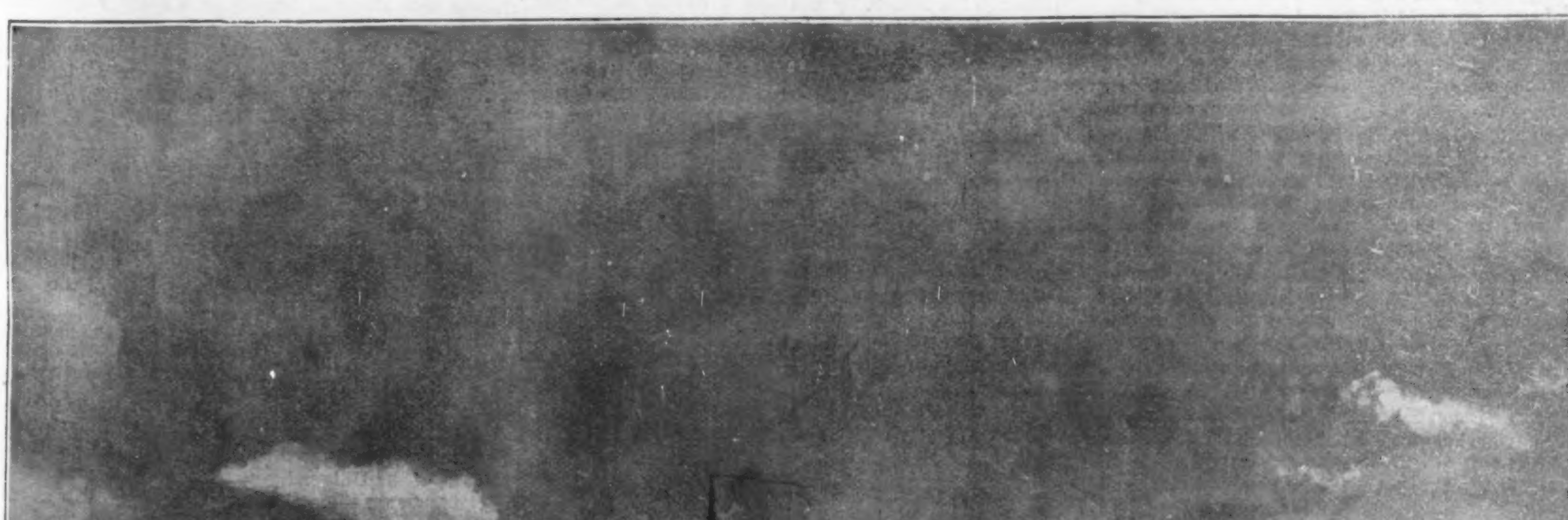
The ship was built under the provisions of the naval appropriation bill of July 19, 1892, her limit of cost being placed at $4,000,000. The contract price was $3,010,000. She is of design furnished by the Bureau of Construction of the United States Navy Department, and has exceeded her required dimensions by some 2,000 tons, while the bid for her construction came nearly $1,000,000 under the legal maximum of cost.



Photographed and copyrighted, 1896, by W. H. Rau.

THE IOWA LAUNCHED MARCH 28, 1896.

The water line is protected for 190 feet of its length amidships by a belt of armor 7 feet 6 inches wide. This belt has a maximum thickness of 14 inches, on 12 inches wood backing. Belts of armor 12 inches thick run across the ship, connecting the ends of the side



THE SEAGOING BATTLESHIP IOWA.

belts. At the forward and after ends of the citadel formed by this armored structure circular barbettes of 16 inch armor are established, with rotating turrets, each turret carrying two guns with axes parallel. The turrets are of 14 inch armor.

This describes the heavy armor of the ship. Above the water line belt a second citadel of 4 inch armor is built, extending 100 feet fore and aft along the sides and with diagonal segments running to the main barbettes. At each of the four corners of this citadel is a barbette of 8 inch armor, with a revolving turret of 5½ inch armor.

The ship is fought from a conning tower of 7½ inch armor, 8 feet in diameter, and with 7 feet 4 inches head room.

The four breechloading rifles in the main turrets are of 12 inches caliber, and the four upper turrets are armed with eight breechloading rifles of 8 inch caliber, two to a turret. The 12 inch guns in the forward turret and the 8 inch guns in the upper turrets are on the same level, their axes being 25 feet above the mean water line. The axes of the 12 inch guns in the after turret are 18 feet above the water line. This somewhat peculiar distribution can be followed out in our cut showing the completed ship at sea.

The sponsons are to carry 4 inch rifles, of which size of gun there are to be six, and twenty-two rapid firing and machine guns are provided for, to be distributed about the ship and on the fighting mast.

The fighting mast has three tops, and, as shown in the cut, is to be a very prominent feature of the ship. There are also bow and stern torpedo tubes and two tubes on each side.

The engines are of vertical inverted three cylinder type, triple expansion, and developing 11,000 horse power at 112 revolutions of her twin screws. There is a coal carrying capacity of 3,000 tons, giving a radius of action of 16,000 miles at a speed of 10 knots.

As additional protection, the Iowa has deflective steel decks and cellulose packing back of her plating. The armor is all Harveyized steel. Samples were subjected to very severe tests before acceptance, and in our issue of November 9, 1895, we described and illustrated some most interesting ballistic tests conducted at Indian Head proving ground, where a plate, representing the Iowa's armor, was attacked by 10, 12, and 13 inch guns, the largest caliber projectile being the only one which succeeded in penetrating the plate.

One feature of the occasion was the lavish hospitality of the builders of the ship—the Cramp company. In addition to the reception on the special trains, they entertained at a lunch in their establishment no less than 1,300 invited guests. The interest of the occasion is better appreciated when the distance traveled by the guests and their high position in the political and scientific world is realized.

In the stream off the yard lay the ship Massachusetts, and her steam siren sounded as the Iowa went down the ways. It will be many months before the ship can be made ready for commission, and some two years will elapse before the launch of another ship of her type and power. The launch may be ranked as one of the most important that ever took place in this country.

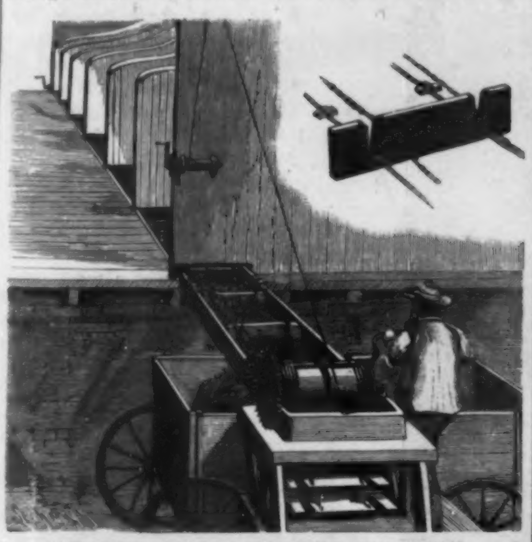
Trolley Road in Japan.

An electric trolley road established at Kioto, Japan, is described and illustrated in L'Energie Electrique. The road has been built by the Thomson-Houston Company, and the current is taken from a central station, which supplies power to a number of silk mills as well as the electric lighting of Kioto. The source of power is a canal from Lake Biwa, which is also used for navigation and irrigation purposes. There are 20 Pelton wheels of about 120 horse power working 12 dynamos, arrangements being made for the employment of alternating currents of from 1,000 to 2,000 volts, and a three-phase system at 2,000 volts, as well as a 500 volt continuous current, the total output being at present about 1,300 kilowatts. One curious feature is an inclined plane 700 meters long, with a fall of 7 per cent, which is used for transporting barges from the canal to the River Ujigawa, and vice versa. This is worked by a cable driven by a 50 horse power Thomson-Houston motor. The electric road is 18 kilometers (11¼ miles) long, and is worked with 26 cars fitted with Thomson motors. It is stated that the results on this road have been so encouraging that the municipalities of Tokio, Yokohama, and Osaka have decided on adopting similar lines.

It is almost an axiom of the legal profession that the law is clear and certain, and the judges know the law. It is one of the first principles of Blackstone that "the law cannot make a mistake." And yet one of the most eminent of English judges, Lord Mansfield, once said, in deciding a case, "as to the certainty of the law, it would be very hard upon the profession if the law was so certain that everybody knew it. The misfortune is that it is so uncertain that it costs much money to know what it is, even in the court of last resort."

A STABLE CLEANING APPARATUS.

For expeditiously removing manure, etc., from stables, the apparatus shown in the accompanying illustration has been invented and patented by Clarence A. Monroe, Loveland, Col. Sunk in the floor at the rear of the stalls is a trough or trench whose ends extend through opposite openings in the walls of the stable, there being at one end brackets in which is journaled a roller or drum, while at the other end the trough has a hinged section, with open bottom, there



MONROE'S STABLE CLEANING APPARATUS.

being journaled at the outer end of this section another drum. On the drum shaft is a gear wheel meshing with a pinion on a shaft provided with a crank handle, whereby the drum may be rotated. From the outer end of the hinged section a cord or rope extends diagonally up over a sheave on the side wall, and thence down over a roller or windlass, whereby the hinged section may be raised to a vertical position or let down over a wagon in a driveway at the side of the stable, as shown in the illustration. Wire ropes are secured at opposite ends to the respective drums, and on these wire ropes are spaced stops adapted to engage the rear sides of flights, as shown in the small figure, the flights being drawn along in an inclined position in the trenches by the cables. As the flights are drawn over the open bottom of the hinged section they are supported by guide rods, but they become disengaged and fall into a chamber at the forward end of the open bottom of the hinged section.

The flights are connected by chains or flexible connections, and are adapted to be drawn backward through the trench, by means of a handle on the rear drum, the flights being held in vertical position by slides adjacent to the rear drum. When the flights are drawn forward the manure is carried out and delivered into a wagon or other receptacle, the flights being then carried back to their original position by rotating the drum at the rear of the trench.

A CAKE BAKED IN A HAT.

Borrowing a hat, breaking some eggs in it, and taking out a cake is a trick which, although old, is worthy of explanation, and the more so in that the process that we are going to describe has the advantage of being able to be employed anywhere and of producing a complete illusion.

Before beginning the experiment, take three eggs, and, having blown

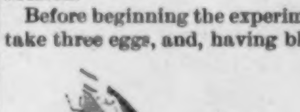


Fig. 1.

Fig. 2.

two of them, close the apertures with white wax. Place the three eggs upon a plate.

Within the left hand side of your waistcoat place a flat cake, and then make your appearance before the spectators.

Having borrowed a hat, place it upon the table, and, after secretly introducing the cake into it (Fig. 1), take an empty egg, crack the shell upon the edge of the plate, and, inserting your hands in the hat, make believe empty the contents of the egg into the latter (Fig. 2).

In order that the means employed may not occur to any one, take the perfect egg and let it fall upon the plate so that it will break and its contents flow out. Then take the remaining egg and operate as with the first. All you have to do then is to pass the hat back and forth a few times over the flame of a candle in order to cook the mass and then to serve the cake.—Magasin Pittoresque.

Science Notes.

Modern Medicine states that an examination of the dust of railroad cars has been made in Germany under the direction of the Imperial Board of Health. The investigations showed that in fourth-class cars there were more than 12,000 germs per meter, and in first-class cars one-fifth this number. Animals were inoculated with the dust from the cars. Some died of tuberculosis, showing the presence of this germ with the other microbes.

In notes presented before the Paris Academy of Sciences, L. B. Gustave le Bon claims that he has proved by photographic effects that ordinary lamp light and gas light are transmitted through opaque bodies, and states that the body might be a sheet of copper one-thirtieth of an inch in thickness. His experiments have been questioned, says Science, by M. Niewenglowski, who states that he has obtained the same effects in complete darkness, and attributes them to luminous energy stored up in the plates.

An imperial ordinance was promulgated in Japan on December 28, 1895, establishing a new standard time, as follows: (1) The standard time of the empire hitherto in use shall henceforth be called the central standard time. (2) The time of the meridian of 120° east longitude shall be the standard time of Taiwan (Formosa), Hoko group (the Pescadores), and Taeyama and Miyako groups, and shall be called the western standard time. (3) This ordinance shall come into effect on January 1 of the twenty-ninth year of Meiji (1896).

Portugal is about to celebrate a quadricentenary of its own. At the request of the Geographical Society at Lisbon, the government has determined to celebrate the four hundredth anniversary of the expedition which set out on July 8, 1497, under the command of Vasco da Gama, for the discovery of a route to India around the Cape of Good Hope. The details of the celebration have not been decided upon as yet, but it is expected that special expositions will be opened at Lisbon and that scientific congresses will also be held.

Cryostase is the name of a new substance discovered by a German chemist. It is a remarkable compound substance and has some curious properties, among which is that of solidifying under the influence of heat and again becoming liquid at temperatures below the freezing point. It is the only substance which possesses the property of liquefying when cold and becoming solidified when hot; for although some substances like albumen harden at a slightly high temperature, they cannot be brought back to a liquid state even under the influence of a very low temperature. Full details of the composition are lacking. It is said to be made by mixing equal parts of phenol, camphor, and saponine, to which is added a rather smaller quantity of turpentine.

The Albert medal of the Society of Arts was presented by His Royal Highness the Prince of Wales to Sir Lowthian Bell, Bart., F.R.S., on February 26, in recognition of the services he had rendered to arts, manufactures, and commerce by his metallurgical researches and the resulting development of the iron and steel industries.

The Conseil Supérieur de l'Instruction Publique, of France, has issued a decree which removes the restrictions imposed on American and other foreign students in French universities and gives them a status similar to that accorded them by the German universities. The memorial addressed to the Conseil by Prof. H. J. Furber, of the University of Chicago, called attention to the fact that there were only thirty students at the Sorbonne, while there were two hundred at the University of Berlin. The conditions will now probably be completely changed by the new decree.

By the use of the electric furnace, G. de Chalmot has obtained crystals of copper and silver silicides, which always contain, however, as an impurity, some calcium.

The Russian National Health Society is making great efforts to have the Jenner Centenary celebration, which is due to be held in May, a great success. An exhibition of relics of Jenner and of books, pamphlets, prints, instruments, and all objects relating to vaccination or to Jenner, will be held. Four prizes and a gold medal are offered for the best work on vaccination.

Acetylene gas is now proposed for various special uses. Among these are hospital work, especially for oculists, aurists, throat operations, and the like. The microscopist and photographer are said to find it of value, and for all special cases of difficult illumination it may be used to advantage. One suggestion is to provide signalmen with compressed gas in small cylinders, to be used for long and short flash Morse signals. Its use for bicycles, the gas being stored in the handle bars or tubular frames, must not be overlooked.

Acetylene Standard for Photometry.

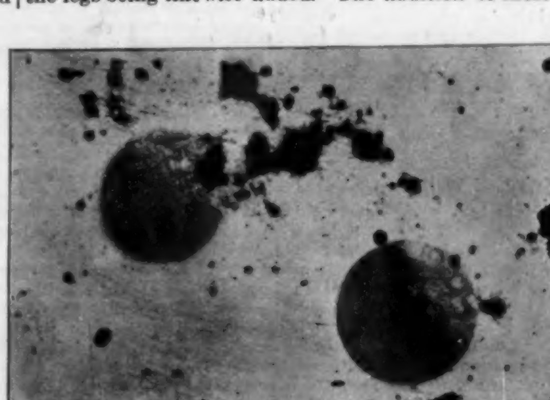
The practical advantages of flames as standards of light have led to their almost exclusive employment for this purpose at the present day. A gas of constant chemical composition, burning under defined conditions, must admittedly form a useful accessory standard. Acetylene, the importance of which has been shown in a masterly study of it by M. Berthelot, appears to be well adapted for the purpose. M. Moissan has found the means of readily preparing the gas in a pure state by the action of water on calcium carbide, which is easily manufactured in the electric furnace. If acetylene is consumed under slight pressure in a burner which gives a broad, shallow flame, the latter is quite steady, very bright, remarkably white, and, for a fairly large surface, of practically uniform luminosity. By placing in front of the flame a screen with an opening of fixed dimensions, which can be varied for particular cases, a source of light well fitted for ordinary photometrical observations is obtained.

These principles were enunciated last year at a meeting of the Société Française de Physique, and M. Charpentier (for whose valuable assistance my thanks are due) has constructed for me a standard lamp embodying them, and easily used. The acetylene, issuing from a small conical orifice, draws in the required air, and then passes through a narrow aperture into a tube in which mixing occurs. This tube ends in a steatite batswing burner, like those employed for illuminating gas. Either the whole or a clearly defined portion of the flame may be used. In the model employed, the flame is inclosed in a small chamber, one of the sides of which is provided with an iris diaphragm, enabling any desired number of candles to be secured. Another side is made to accommodate plates with previously calibrated apertures. The whole flame corresponds to more than 100 candles, under a pressure of 0·30 meter of water, and a consumption of 58 liters (2·049 cubic feet) per hour. The illuminating power of acetylene is therefore more than twenty times that of coal gas burnt in a Bengal burner, which gives 1 carcel (9·6 candles) per 105 liters (3·708 cubic feet), and at least six times that of coal gas consumed in a Welsbach burner, which gives one carcel per 30 liters (1·059 cubic feet). Moreover, spectrophotometry shows that for the whole length of the spectrum, from C to F, the light from acetylene differs little from that of platinum in a state of fusion. The latter is employed as the absolute unit, and it is so related to the candle that this is defined as one-twentieth of that unit. Photography, which offers the best means of studying rays of small wave length, shows that in the flame of acetylene there is an actinic intensity, which should prove of most valuable service.—M. Violle in Comptes Rendus.

RADIOGRAPHY.

In the March number of the Red and Blue, of the University of Pennsylvania, is given an account of Roentgen photography and some experiments made at the university in the same direction by Dr. Arthur W. Goodspeed, assistant professor of physics. These experiments were successful repetitions of the experiments of Roentgen and others, together with original work; but the item of greatest interest was contained in the last clause of the article referred to, which we produce, together with cut of the first shadow picture, for which we are indebted to the magazine above mentioned.

In the year 1890, Mr. Jennings, of Philadelphia, had associated himself with Dr. Goodspeed in experiments on spark photography. One evening, the 22d of February, 1890, at the close of work, with the table still littered by plate holders and apparatus, Dr. Goodspeed brought out the Crookes tubes for Mr. Jennings' amusement. Next day that gentleman wrote that he had had a curious failure among his plates—a negative spotted by two disks; but since no one could explain the phenomenon, comparatively uninteresting as it was, the plate was thrown aside and forgotten. Six years later after the discovery of the Roentgen rays, it was recalled to mind and recovered. A duplicate was prepared under exactly the same circumstances; both plates exhibited the same indications of genuineness—the sharp line at one edge of the disk, the dull line of shadow at the farther edge. These photographs the Red and Blue has the honor of presenting for the first time. It was in a lecture on the evening of University Day that Dr. Goodspeed told the story, and concluded thus: "We can claim no merit for the discovery—for no discovery was made. All we ask is that you remember, gentlemen, that six years ago, day for day, the first picture in the world by cathodic ray was taken in the Physical Laboratory of the University of Pennsylvania."



THE FIRST SHADOW PICTURE IN THE WORLD.
Taken by accident at the University of Pennsylvania, February 22, 1890.

DR. CHANTEMESSE, of Paris, has it is said discovered an anti-typhoid serum, with which he has experimented on three patients. After the first hypodermic injection they passed through the ordinary stages of the disease and became convalescent.

AN INTERESTING ARCHÆOLOGICAL DISCOVERY.

We have received the following letter from Mr. George E. Raum, late of San Francisco:

Cairo, Egypt, February. 29, 1896.

To the Editor of the SCIENTIFIC AMERICAN:

Dear Sir: I inclose a rough sketch of a portion of the rock crown of the Sphinx found by me. This portion of the stone crown or diadem of the Sphinx was found at the bottom of the temple, between its forepaws, on February 26, 1896. Originally this stone crown was in all probability ten feet broad and as high

CAP OR DIADEM OF THE SPHINX.

again, with a stone stem seven feet long, which fitted into the perpendicular hole in its head, to hold it on. We now know how the Sphinx originally looked.

Yours truly, GEORGE E. RAUM.

This discovery of Col. Raum is of great interest, though the statement of the find has been received with incredulity in some quarters. The arguments of the gentlemen who are inclined to disbelieve in the authenticity of the stone found are not convincing, being principally based on the fact that the temple has been excavated by several modern explorers—Caviglia, Mariette, and M. Maspero. Again, others state that "it is not usual to hear of holes 'drilled' by the ancients in their monuments," but the Egyptians worked hard stones with bronze saws set with corundum or diamonds, and for tubular drilling they had tools like our modern diamond rock drills (see Engineering, xxxvii, page 282). Another point which has been made is that there are three lotus columns on the cap. This is more reasonable criticism and may possibly be satisfactorily explained. The fallibility of Egyptologists is well known, but until some really convincing proof is brought forward, it is probably safe to believe that the marked stone found by Mr. Raum is the cap or diadem of the Sphinx.

The Egyptian Sphinx was usually an emblematic figure representative of a king, and may be considered, when with the head of a man and the body of a lion, as the union of intellect and physical force. The Great Sphinx lies about 1,800 feet southeast of the Great Pyramid of Gizeh. It is a recumbent androsphinx, or man-headed lion, hewn out of a natural eminence in the solid rock. Owing to certain defects in the rock, these faults were remedied by a partial stone casing, the legs being likewise added. The addition of these pieces militates against the argument that the cap so recently found could not have belonged to the Sphinx, as it did not form a part of the solid rock. An excellent idea of this hoary monument of antiquity may be obtained from the engraving in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 864. The Sphinx has been variously measured. The figures given by Mr. E. L. Wilson are length, 155 feet; height from the base, 63 feet. Between the paws is a temple (?) which speedily fills up with sand after being excavated. It is considered that the Sphinx is older than the Great Pyramid. Various interpretations have been given to this boldly sculptured figure which rises out of the waste of sands. Cambyses mutilated the face of the Sphinx, and it may have been at this time that it lost its cap.

The brow of the Sphinx is nearly 14 feet broad; so the cap, which is 4 feet 6 inches long at the bottom, probably only formed the tip of the cap, as stated by Mr. Raum. Col. Raum obtained permission to excavate in and around the Pyramids and Sphinx from the Egyptian government. He came upon the cap at a depth of fourteen or fifteen feet below the surface in the temple (?) between the forepaws. The stone is painted red in the decorations, as was in order, as the countenance of the Sphinx was originally of a reddish hue. The cap is irregular in shape, measuring 2 feet 2 inches at the top and 4 feet 6 inches at the bottom; on the left side, from top to bottom, it measures 2 feet 8 inches. The left side has a conventional decoration. In the center are three lotus columns and a fish, on the right side is a portion of the sun's disk. The wonderful discoveries conducted by Mr. L. De Morgan, at Dahshur, Egypt, are described in the current issue of the SUPPLEMENT. The tomb of Queen Khnemit was unearthed by the discoverer and a beautiful golden crown and other ornaments of elaborate workmanship were found.

Fire from Steam Pipes.

The burning of the Warren (R. I.) cotton mill having been attributed to the carbonizing of the wooden lagging on the cylinder of the large quadruple expansion engine, again brings up the possibility of wooden coverings to steam pipes taking fire without the presence of a spark to start the combustion, and some recent investigations by the Boston Manufacturers' Mutual Fire Insurance Company are of considerable interest. In a report of these investigations, appearing in the Providence Journal, several instances are given where wood coverings, although separated from steam pipes by several thicknesses of hair felt and other coverings, became badly charred and in several instances actually took fire.

Mr. Edward Atkinson, president of the company, says that it is sometimes held that this finely carbonized wood will not ignite from any cause except actual contact by spark or flame from an outside source. In proof that charcoal in a porous condition will ignite from the sudden influx of fresh air, he cited an example in his own experience.

Having had occasion to test heat-retarding substances on his own behalf, he once obtained some sections of prepared wood pulp in slabs of 1⅛ inches in thickness and of a very porous quality, which are made use of in the construction of refrigerators. His purpose was to determine whether or not such slabs could be used to prevent the escape of heat from a lamp oven. He therefore raised the heat of the inner oven, which is a tight inner iron box one inch distant on all sides from an outer case made of vulcanized and very solid wood pulp, to a little under 400 degrees. In the center of that inner oven, isolated from any metallic contact with the wall, was placed one of these slabs and there left subject to heat at less than 400 degrees for about one hour. He then removed the front of the outer oven and opened the door of the inner oven, letting a very quick and large supply of fresh air into the chamber, in which the oxygen had probably been in part exhausted by subjection to the hour's heat. The slab of wood pulp had turned from pure white to dense black, having been converted into very porous charcoal. In less than a minute after the fresh air was let in it took fire and burned to ashes. He repeated the experiment with the same result. Four hundred degrees Fahrenheit will be developed by a pressure of steam of 238 pounds per square inch, but the same carbonization ensues by lapse of time even at boiling heat, or 212 degrees, as has been proved.—The Engineering Record.

Life of a Cannon.

La Nature contains a short note in which the horse power of a cannon is calculated. An Italian cannon of 100 tons with a charge of 550 lb. of powder and a shot weighing about 2,000 lb., will give an initial velocity of 523 meters per second; the length of time during which the powder acts is less than one-hundredth of a second, from which it follows that the horse power developed is about 17,000,000. The writer adds that after about 100 shots the cannon is put out of service and its total active life is, therefore, only one second! In large modern cannon the horse power runs as high as 24,000,000. If the writer had carried out these calculations still farther, he would have found that, after all, this 24,000,000 horse power does not represent a large amount of energy, as it would be just sufficient to run 31 incandescent lamps for only one day.

PROFS. AYRTON and Medley find that incandescent lamps appear to increase in effectiveness during the first 80 or 100 hours of use, after which the light slowly fails.

RECENTLY PATENTED INVENTIONS.

Mechanical.

Mechanism for Operating Rollers.—Jules Richard, Paris, France. According to this invention, there is a loose roller on each of two shafts, a spring movable on each shaft being adapted to be pressed into engagement with the rollers, while a reciprocal cam plate alternately engages and disengages the springs, the mechanism being adapted for operating rolls on which ribbons, aprons, etc., are wound, and rendering it possible to adjust the parts so that when the ribbon or apron is being moved in one direction it will be impossible to accidentally move it in the wrong direction.

Coloring or Coating Paper.—Louis Dejonge, Jr., Stapleton, N. Y. This is an improvement on a formerly patented invention of the same inventor, providing a machine for coloring or coating paper and like material, and making provision on the cylinder of the machine for sheets of any size, the adjustment of the bed receiving the sheets being quickly and conveniently made, improved grippers being adapted to hold the paper on the bed. The invention also simplifies the devices for elevating the paper and holding it in position until caught by the clips of the drying machine used in connection with the coloring and coating machine.

Power Sled.—Joseph, William H., and Moses C. Rannor, Crested Butte, Col. This invention provides a self-propelling sled, carrying a motor, and one which may be driven over snow and ice with sufficient power to haul or carry a load, being provided with easy means of steering. Its driving mechanism is adjustable to suit varying depths and conditions of snow, and it has an improved snow plow adapted to discharge the snow to either or both sides. It is also adjustable vertically to enable it to scoop the snow to any desired depth.

Agricultural.

Cultivator and Weed Cutter.—Alfred J. Morley, Chula Vista, Cal. This is a machine having readily removable cultivator teeth or shovels, so shaped as not only to cultivate the ground but to throw the earth, assisted by the teeth supports, toward the center of the machine or to the outside. The frame constitutes substantially a continuous plate, directing the loosened soil over to the rear and insuring the breaking of ground not acted on by the teeth or shovels. The machine acts also as a pulverizer and leveler, the frame smoothing over the loosened soil, and a comb finally treating the surface over which the machine is passed.

Fertilizer Distributer. — Monroe Morse, Medway, Mass. This is a machine adapted to distribute fertilizer in drills as readily and as accurately as broadcast, the extent to which the material is scattered being conveniently regulated. It has distributing hoppers adjustable to and from each other, each having a valve-controlled opening and the valves being capable of rotary or vertical movement, and the driving shaft is made in telescopic sections, to be lengthened or shortened according to the spacing of the hoppers. The machine is inexpensive and durable, and is not liable to clog.

Sausage Filling Machine. — Richard W. Sekleman, Marysville, Montana. This is a self-feeding machine, to be operated by hand or power, and when operated by hand one person furnishes the power while the other places the casings in position and removes the filled casings. The casings are placed on tubular supports attached to a wheel, a number of casings being placed in position while one is being filled. The operation is conducted in a continuous manner, and air is not forced in with the meat.

Miscellaneous.

Toe Clip for Velocipedes.—Samuel L. Ruden, New York City. A superior toe clip for the pedals of these machines is obtained by this inventor by means of a U-shaped plate pivotally mounted and adapted to have one arm engaged by the sole of the rider's foot, the remaining arm being drawn down upon the toe of the user.

Horse Hitching Device.—Uriah E. Miller and Paul Barringer, Heilig, N. C. This is a simple device adapted as a substitute for the ordinary hitching strap, the wheels of the vehicle being readily locked and the locking mechanism being connected with the driving lines of the harness, the arrangement being such that the animal will be prevented from moving the vehicle forward or backward. The more the animal draws on the hitching straps, the firmer they are locked.

Branding Cigars.—Paul Gebhard, New Haven, Conn. To brand cigars with a name or emblem and at the same time cut the cigar to the desired length, this inventor provides a device comprising two hinged sections with a cigar-receiving groove in one section and a type groove and movable plates in the other section, there being a set screw for each plate. A graduated gage for regulating the length of the cigar is adjusted by a set screw, and a knife in each section cuts the cigar to the proper length at the same time that the type characters make an impression on the wrapper.

Price Scale. — Harry Fisher, Neoga, Ill. This invention consists principally of a movable point of connection between the weighing beam and the weighing frame, thus forming a computing scale to give the value of an article at a given price per pound or other unit, the price being varied by the operator manipulating the scale. A movable weight automatically preserves the balance of the beam through all changes of the connection between the weighing beam and the weighing frame.

Convertible Table and Kit Case.—William E. Baxter, Frankfort, Ky. Two patents have been granted this inventor for a foldable construction to serve as a box or case for the papers of an army officer or to inclose the utensils of a kit with table legs and braces, or as a flat or grass table or an elevated table. Sufficient space is afforded for the storage of coffee pot, bucket and other necessary articles of a well equipped camp kit, and the invention covers a novel construction, combination and arrangement of parts.

Fire Extinguishing Apparatus. — Elias K. Driver, Lufkin, Texas. This is an apparatus more especially designed for use in gin mills, saw mills, factories, etc., and is arranged to enable an attendant to quickly turn on water or steam to extinguish flames in or outside the building. A valved supply pipe is connected with the steam boiler, and branch pipes extend vertically therefrom within and outside of the building, discharge nozzles being flexibly connected with the branch pipes, and the discharge nozzles being under the control of the operator to direct streams as desired.

Fence.—Robert S. Sayre, Talladega, Ala. This inventor has devised a portable panel fence of simple and inexpensive construction and which is light, strong and durable. The rail forming the body of the trestle for other parts of the panel is preferably an undressed tree trunk, to which are removably secured diverging legs adapted to slightly enter the ground, while vertical perforations receive braced standards connected by fence wires or wooden strips. The fence sections may be readily loaded on a wagon to be taken from place to place.

Wire Fence.—Ross Phillis, Springfield, Ohio. This invention provides novel braces or stay pieces for the wires comprising the fence, and affords reliable means for securing the fence wires on supporting posts, permitting expansion and contraction of the wires and the taking up of slackness. The fence wires are prevented from being moved up or down or lengthwise when pressed against by animals, and the stays or rods may be removed at will without injury to the fence wires.

Sportsman's Fly Case. — Daniel K. Howe, Portland, Oregon. A case for carrying fly hooks and leaders and also adapted to serve as a pocket flask for liquid refreshment has been devised by this inventor. The casing has at one end a metal cap suitable for use as a drinking cup, and a liquid proof partition divides the casing into a number of chambers adapted to receive flies, sinkers, etc., and hold them without liability to damage, but so as to be readily removable. The lower end of the casing consists of a small reservoir or chamber provided with a screw cap.

Collar.—George S. Elliott, Bar Harbor, Me. This is a standing collar made with a necktie retainer, consisting of a tape secured at its ends to the collar to form a loop. The tape is extended longitudinally of the collar underneath one of the end buttonholes and the necktie end is passed vertically through the loop before completing the knot.

Business Directory. — John D. Browning, Louisville, Ky. This is a telephone list and business directory combined, comprising a novel arrangement of sheets or boards with names of subscribers in alphabetical order, with the names of other parties following various occupations, as indicated on the margins, the directory affording a convenient and ready reference to parties carrying on different kinds of business.

Design for Mirror Frame.—Albert Wanner, Jr., Hoboken, N. J. This frame has legs in the form of foliated scrolls, which are continued around the outer border of the frame, and combined in a central line to form lyrelike figures.

Note.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(6812) **D. B. K. says: Will you kindly** give me recipe for making a good leather cement, suitable for fastening small leather belts? A. Take of common glue and gelatine, equal parts; place them in a boiler and add water sufficient to just cover the whole. Let it soak ten hours, then bring the whole to a boiling heat, and add pure tannin until the whole becomes ropy or appears like the white of eggs. Apply it warm. Buff the grain off the leather where it is to be cemented; rub the joint surfaces solidly together, let it dry a few hours, and it is ready for practical use; and if properly put together, it will not need riveting, as the cement is nearly of the same nature as the leather itself.

(6813) **W. H. S. says: By accident I tore** a good rubber coat. How can I mend same? A. Cement for sticking on patches and for attaching rubber soles to boots and shoes is prepared from virgin or native India rubber, by cutting with a proper solvent. We advise you to use rubber bicycle tire cement. Apply a coating to the outside of the surface on each side of the tear and to one side of the piece of rubber fabric to be used for mending. After an hour's exposure, give a second coating and let them stand over night. Then place the edges of the tear accurately together and apply the patch, so that the coated surfaces come together. Press well together and the repair is made. Rubber cement depends for its action on the cohesive power of pure rubber surfaces—it operates entirely differently from a true cement. Strictly speaking, it should not be called a cement.

(6814) **W. B. B. writes: 1. Please inform** me through your paper how the connections are made to get the waste current from an electric railroad track. I saw the account of it in your paper, but have lost the paper. A. Sometimes by connecting one wire to the water pipe and the other to the gas pipe, current may be obtained. There is no fixed method. 2. Could I make a Crookes tube with an incandescent lamp globe? A. The vacuum is insufficient generally for X ray work, which is very exacting. 3. How many dry cells would it take to operate it with an induction coil? A. From twenty upward; the induction coil must be large enough to give at least a 2 inch spark.

(6815) **M. W. C. writes: Will you** answer the following problem in your columns? Prove that $x+\frac{1}{2}y=\pi$, if

$$\frac{\sin y}{1-\cos y}+\frac{\cos x}{\sin x}=0.$$

A. From circular functions we have

$$\frac{\sin y}{1-\cos y}=\cot \tfrac{1}{2} y$$

and, also,

$$\frac{\cos x}{\sin x}=-\cot x.$$

We also know that the cotangent of the supplement of an arc = −cotangent of the arc. Therefore, since

$$\cot \tfrac{1}{2}y=-\cot x$$
$$x+\tfrac{1}{2}y=180^\circ=\pi.$$

(6816) **B. S. B. says: Will you please** tell me how to make a waterproof glue for sticking paper, etc.? I would like it to be colorless and mix very thin. A. In order to render glue insoluble in water, even hot water, it is only necessary, when dissolving the glue for use, to add a little potassium bichromate to the water and to expose the glued part to light. The proportion of potassium bichromate will vary with circumstances; but for most purposes about one-fiftieth of the amount of the dry glue used will suffice. In other words, glue containing potassium bichromate, when exposed to the light, becomes insoluble.

(6817) **L. A. M. says: Can you tell how** to whitewash brick walls so that it will stick well? A. For brickwork, especially where exposed to damp, take half a peck of well burned quicklime, fresh from the kiln, slake with hot water sufficient to reduce it to a paste, and pass it through a fine sieve; add a gallon of clean white salt which has been dissolved in a small quantity of boiling water, and a thin, smooth paste, also hot, made from 1 pound of fine rice flour; also ¼ of a pound of the best white glue, made in the water bath. Mix, stir well, add ¼ of a pound of the best Spanish whiting in 5 quarts of boiling water; stir, cover to retain heat and exclude dust, and let it stand a week. Heat to boiling, stir, and apply hot. The above proportions will cover forty square yards.

(6818) **S. A. S., Texas, asks: Would a** gasoline engine compressing its volume 15 per cent produce as much power as one compressing it 30 per cent? Why? What is the strongest metal for its weight? A. Compressing the gas and air mixture in a gas engine produces quicker combustion and greater explosive pressure. A 30 per cent compression will produce more power than a 15 per cent compression, but there is probably a limit to the economy of compression by its increasing the negative pressure. The relative volumes of gas and air also have a controlling effect in compression gas engines. One part gas to six parts air gives the highest efficiency in the higher compression, probably up to three atmospheres. The heat of compression also favors rapid and perfect combustion. Aluminum and steel are of equal strength in ratio of their weight. A small percentage of copper in aluminum increases its tensile strength in proportion to its weight.

(6819) **W. R. says: How are the yellow** or light spots on the wrapper of a cigar produced? Of course not those that are of natural, but of artificial origin. I have heard it is done by sprinkling the tobacco leaves with a kind of acidous liquid, that will not destroy the texture of the leaf. A. We have not this information at hand. Perhaps some of our readers may be able to inform us.

(6820) **G. E. M. asks how to arrive at** the number of kilowatts in the case of an electric train requiring 200 amperes for 20 hours per day, with voltage at 500. A. 200 amperes × 500 volts gives 100,000 watts, or 100 kilowatts. The hours per day has nothing to do with the problem.

(6821) **J. D C. asks: What would be** the number of turns of No. 18 copper wire to use with 1⅛ pounds No. 36 wire, to get the longest spark with a Rhumkorf coil? That is, I want to know the proportion. I already have the 1⅛ pounds No. 36 wire, and want to know how much No. 18 to use for the primary. Does the absence of a condenser reduce the length of the spark very much? A. The general principle is, that the more primary you use, the longer will be the spark, because the length of the spark will be greater, as there are more turns in the primary wire. Try one pound of wire for the primary; this will give you about 200 feet, enough for 600 to 1000 turns. The omission of a condenser will seriously impair the operation and will diminish the length of spark. See our Supplement, No. 160, for a small induction coil.

(6822) **R. W. P. writes: 1. The C. G. S.** unit of current strength is defined thus: "A current has unit strength when one centimeter length of its circuit bent into an arc of one centimeter radius (so as to be always one centimeter away from the magnet pole) exerts a force of one dyne on a magnet pole placed at the center." My question is, does it make any difference what the diameter of the magnet pole is? And if it does, what should its diameter be, its thickness I mean? Of course only a geometrical point would be placed at the center. A. The magnet pole is supposed to be a point or equivalent thereto. 2. Unit difference of potential exists between two points when it requires the expenditure of one erg of work to bring a unit of + electricity from one point to the other against the electric force. The volt being 10^8 of these units, it becomes important for me to know how to tell whether, in any given case, the unit difference of potential (as just defined) exists or not. In actual practice, such as would be necessary in the derivation of the volt, how is the difference of potential determined in these absolute units? A. For absolute measurements very sensitive instruments are used. The various types of electrometers give potential determinations with accuracy. You will find the subject well presented in Ayrton's "Practical Electricity," $2.50 by mail, with numerous examples of apparatus both of electrometer and of galvanometer type. Emptage on "Magnetism," $2.25 by mail, gives excellent treatment of the subject of your first query. For higher mathematical treatment we refer you to Foster & Atkinson's "Elementary Treatise on Electricity and Magnetism," price $2.25 by mail.

(6823) **R. P. B. asks: 1. Is the ordinary** calcium carbide dangerous to handle? If so, how can I handle it in safety? A. Carbide of calcium is perfectly safe to handle if no water comes in contact with it. 2. Can it be put into an airtight vessel with small opening in which there is placed an outlet or jet for the consumption of the gas generated therein? A. To preserve it, use an airtight vessel with no outlet. The outlet will simply cause it to decompose. 3. In what issue was the apparatus for generating the gas in, for illuminating purposes? Also numbers describing the properties of the gas and other general information relating thereto. A. For several standard apparatus we refer you to the Scientific American Supplement, No. 1057; other papers are in the Scientific American Supplement, Nos. 998, 1004, 1007, 1012, 1014, 1015, 1016, 1035, and 1038, price 10 cents each, mailed.

(6824) **M. E. S. says: Will you kindly** tell me how to mix soap suds for making bubbles? I have been told there are other ingredients necessary besides the soap and water, to bring them to lasting perfection. A. For soap bubble solution the best material is pure oleate of soda. Oleic acid as sold in the shops is far from reliable, containing one or more other fatty acids, such as stearic acid. To make the pure acid, 2 ounces of pure soap (almond oil is the best, but Castile will answer) are dissolved in 20 ounces of boiling water. One ounce of sulphuric acid, previously diluted with 2 ounces water and allowed to cool, is added. The fatty acids rise to the surface in an oily layer. The water is siphoned off, and they are washed three times with boiling water. The mass is allowed to cool, and is removed from the surface of the water, where it floats. It is weighed, mixed with ½ its weight of litharge, and heated (212° to 225° Fah.) until complete combination is effected. This may be known by the cessation of any evolution of bubbles from the mass. The resulting lead plaster is allowed to stand mixed with 10 to 15 times its weight of ether in a tightly corked bottle, until completely disintegrated. Then it is filtered, and to the filtrate hydrochloric acid is added as long as any lead is precipitated. The ethereal solution is poured off, and the ether recovered by distillation, leaving pure oleic acid. Two fl. drm. of the acid is added to somewhat less than 1 pint of boiling water, and solution of caustic soda very carefully added, drop by drop, until complete solution of the acid is effected, very carefully avoiding an excess of soda, and after cooling, water is added to make it measure 1 pint. A standard soap solution is thus obtained. To this add ½ its bulk of the best glycerine (Scheering & Glatz's, or Price's). Shake long and well, and the mixture is ready for use. For additional bubble mixtures and interesting experiments on soap bubbles, see Scientific American Supplement, Nos. 160, 495, 563, 579, 654.

(6825) **W. K. W. writes: 1. The saving** of copper is very great in three-wire system of electric lighting, but I notice it is rarely, if ever, used in insulated plants. Can you tell me the reason for this? A. There is no reason why this system should not be used by authorized parties. There is an economy in copper for lamps of specified voltage, but not for a given maximum voltage in the system. 2. Are 220 volt lamps used in this system or 110? A. About 110 volts is the rule in this country. 3. How can arc lamps be run on incandescent circuit? A. By using a resistance coil in circuit with each lamp. See our Supplement, No. 955. 4. Do you think that a good knowledge of steam engineering can be got from a school of correspondence? A. A good theoretical knowledge, which would make the practical part very much easier to obtain—for it is necessary to have practical experience.

(6826) **J. L. O. writes: 1. I have access** to a 10 light dynamo, the current of which can be passed through the body without being felt, unless the machine is out of order. A. The dynamo is so well constructed that it gives but little extra current, owing to the absence of sudden changes in E.M.F. A steady voltage has little effect on the body. 2. Please explain the principles of an alternating current dynamo or motor. Is it stronger than direct, and, if so, why? A. Our Supplement and back numbers of the Scientific American explain alternating current dynamos and motors. They are neither stronger nor weaker than direct current. You will find Leyden jars described in any work on physics.

(6827) **G. S. asks: What is the cheapest** (and the longest life) battery or batteries for operating motor 641; Can No. 20 on the armature and No. 18 on the fields be used for the same? Can you give me some information regarding electric motors actuated by alternating currents? Can a motor (small one) be driven from the secondary of an induction coil—a very powerful one? If so, how and why? A. The secondary or storage battery is the best for driving motors. A bichromate battery, such as described in our Supplement, No. 792, can be used. Many secondary batteries are described in our Supplement, Nos. 641 and 898 and others. For information about alternating current motors we refer you to our Supplement, Nos. 601, 653, 692, 717, 763, 893, 944, and 1025. The numbers of wire specified can be used on the motor. The secondary of an induction coil cannot be used, except experimentally, to drive a motor. A special motor should be used, and it would give very slight power.

(6828) **W. C. Van N. asks: 1. What is** the law for determining the size of wire to be used in induction coils? A. The primary is made large enough to take the current it is proposed to use. There is no other fixed rule. 2. Is the voltage of a secondary coil in an induction coil increased by using finer wire, if the length remains the same? A. No; the voltage depends on the ratio between the turns in primary and secondary.

3. Please give title of a work, other than Hopkins and Dyer, on construction and law of currents of induction coils. A. We can supply "Induction Coils and Coil Making," by Allsop, price $1.25, and "Induction Coils, a Manual for Coil Makers," by Bonney, price $1, mailed.

(6829) M. H. says: I am making an induction coil from SUPPLEMENT, No. 160. How much more wire would be used if I used No. 26, instead of No. 36, on the secondary coil? A. Use enough to get the same number of turns.

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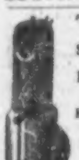

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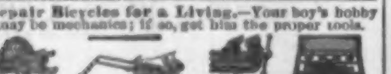

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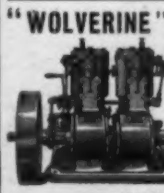

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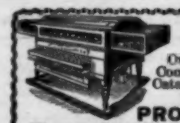

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